NAT'L INST. OF STAND & TECH
A11107 263081

NBS SPECIAL PUBLICATION 392

U.S. DEPARTMENT OF COMMERCE / National Bureau of Standards

National Bureau of Standards
Library, E-01 Admin. Bldg.

OCT 1 1981

191023

QC
100
.U57

Vibrationally Excited Hydrogen Halides:

A Bibliography on Chemical Kinetics of Chemiexcitation and Energy Transfer Processes (1958 through 1973)

QC
100
.U57
no. 392
1974
c.2

NATIONAL BUREAU OF STANDARDS

The National Bureau of Standards[1] was established by an act of Congress March 3, 1901. The Bureau's overall goal is to strengthen and advance the Nation's science and technology and facilitate their effective application for public benefit. To this end, the Bureau conducts research and provides: (1) a basis for the Nation's physical measurement system, (2) scientific and technological services for industry and government, (3) a technical basis for equity in trade, and (4) technical services to promote public safety. The Bureau consists of the Institute for Basic Standards, the Institute for Materials Research, the Institute for Applied Technology, the Institute for Computer Sciences and Technology, and the Office for Information Programs.

THE INSTITUTE FOR BASIC STANDARDS provides the central basis within the United States of a complete and consistent system of physical measurement; coordinates that system with measurement systems of other nations; and furnishes essential services leading to accurate and uniform physical measurements throughout the Nation's scientific community, industry, and commerce. The Institute consists of a Center for Radiation Research, an Office of Measurement Services and the following divisions:

Applied Mathematics — Electricity — Mechanics — Heat — Optical Physics — Nuclear Sciences[2] — Applied Radiation[2] — Quantum Electronics[3] — Electromagnetics[3] — Time and Frequency[3] — Laboratory Astrophysics[3] — Cryogenics[3].

THE INSTITUTE FOR MATERIALS RESEARCH conducts materials research leading to improved methods of measurement, standards, and data on the properties of well-characterized materials needed by industry, commerce, educational institutions, and Government; provides advisory and research services to other Government agencies; and develops, produces, and distributes standard reference materials. The Institute consists of the Office of Standard Reference Materials and the following divisions:

Analytical Chemistry — Polymers — Metallurgy — Inorganic Materials — Reactor Radiation — Physical Chemistry.

THE INSTITUTE FOR APPLIED TECHNOLOGY provides technical services to promote the use of available technology and to facilitate technological innovation in industry and Government; cooperates with public and private organizations leading to the development of technological standards (including mandatory safety standards), codes and methods of test; and provides technical advice and services to Government agencies upon request. The Institute consists of a Center for Building Technology and the following divisions and offices:

Engineering and Product Standards — Weights and Measures — Invention and Innovation — Product Evaluation Technology — Electronic Technology — Technical Analysis — Measurement Engineering — Structures, Materials, and Life Safety[4] — Building Environment[4] — Technical Evaluation and Application[4] — Fire Technology.

THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY conducts research and provides technical services designed to aid Government agencies in improving cost effectiveness in the conduct of their programs through the selection, acquisition, and effective utilization of automatic data processing equipment; and serves as the principal focus within the executive branch for the development of Federal standards for automatic data processing equipment, techniques, and computer languages. The Institute consists of the following divisions:

Computer Services — Systems and Software — Computer Systems Engineering — Information Technology.

THE OFFICE FOR INFORMATION PROGRAMS promotes optimum dissemination and accessibility of scientific information generated within NBS and other agencies of the Federal Government; promotes the development of the National Standard Reference Data System and a system of information analysis centers dealing with the broader aspects of the National Measurement System; provides appropriate services to ensure that the NBS staff has optimum accessibility to the scientific information of the world. The Office consists of the following organizational units:

Office of Standard Reference Data — Office of Information Activities — Office of Technical Publications — Library — Office of International Relations.

---

[1] Headquarters and Laboratories at Gaithersburg, Maryland, unless otherwise noted; mailing address Washington, D.C. 20234.
[2] Part of the Center for Radiation Research.
[3] Located at Boulder, Colorado 80302.
[4] Part of the Center for Building Technology.

Vibrationally Excited Hydrogen Halides:
A Bibliography on Chemical Kinetics of Chemiexcitation and Energy Transfer Processes (1958 through 1973)

National Bureau of Standards
MAY 6 1974

Francis Westley

Chemical Kinetics Information Center
Institute for Materials Research
National Bureau of Standards
Washington, D.C. 20234

This work was supported by the
NBS Office of Standard Reference Data
and
the Air Force Office of Scientific Research
1400 Wilson Blvd., Arlington, Va. 22209

U.S. DEPARTMENT OF COMMERCE, Frederick B. Dent, *Secretary*
NATIONAL BUREAU OF STANDARDS, Richard W. Roberts, *Director*

Issued April 1974

Supt. of Docs. No. C13.10:392
1. Chemical reaction, Rate of—Bibliography. 2. Hydrogen halides—Bibliography. 3. Energy transfer—Bibliography. I. United States. National Bureau of Standards. Institute for Materials Research. Chemical Kinetics Information Center. II. Title. III. Series: United States. National Bureau of Standards. Special Publication 392.

QC100.U57 No. 392 [Z5524.R5] 389'.08s 74-5358
[016.541'39]

National Bureau of Standards Special Publication 392

Nat. Bur. Stand. (U.S.), Spec. Publ. 392, 81 pages (Apr. 1974)
CODEN: XNBSAV

U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON: 1974

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
(Order by SD Catalog No. C13.10:392). Price $1.30

Foreword

The National Standard Reference Data System was established in 1963 for the purpose of promoting the critical evaluation and dissemination of numerical data of the physical sciences. The program is coordinated by the Office of Standard Reference Data of the National Bureau of Standards but involves the efforts of many groups in universities, government laboratories, and private industry. The primary aim of the program is to provide compilations of critically evaluated physical and chemical property data. These tables are published in the *Journal of Physical and Chemical Reference Data,* in the NSRDS-NBS series of the National Bureau of Standards, and through other appropriate channels.

The task of critical evaluation is carried out in various data centers, each with a well-defined technical scope. A necessary preliminary step to the critical evaluation process is the retrieval from the world scientific literature of all papers falling within the scope of the center. Each center, therefore, builds up a comprehensive well-indexed bibliographical file which forms the base for the evaluation task. Bibliographies derived from these files are published when they appear to be of value to research workers and others interested in the particular technical area.

Further information on NSRDS and the publications which form the primary output of the program may be obtained by writing to the Office of Standard Reference Data, National Bureau of Standards, Washington, DC 20234.

David R. Lide, Jr., Chief
Office of Standard Reference Data

TABLE OF CONTENTS

Introduction. 1
Guidelines for the user 7
Journal and report codes. 11
Part I. Hydrogen fluoride (HF, DF) 15
A. Formation of $HF^{\ddagger}$ ($DF^{\ddagger}$) 15
1. Bimolecular reactions (Abstraction lasers) 15
a. Abstraction of H (D) atom by F atom. 15
i. $F + H_2 \rightarrow HF^{\ddagger} + H$ 15
ii. $F + HX \rightarrow HF^{\ddagger} + X$ 16
iii. $F + RH \rightarrow HF^{\ddagger} + R$ 17
b. Abstraction of F atom by H (D) atom. 17
i. $H + F_2 \rightarrow HF^{\ddagger} + F$ 17
ii. $H + FX \rightarrow HF^{\ddagger} + X$ 18
iii. $H + RF \rightarrow HF^{\ddagger} + R$ 18
2. Unimolecular reactions (Elimination lasers). 18
a. $R_1 + R_2 \rightarrow [R_1R_2]^{*} \rightarrow HF^{\ddagger} + M$ (Chemical activation) 18
b. $M_1 + h\nu \rightarrow HF^{\ddagger} + M_2$ (Photochemical elimination) . 19
B. $HF^{\ddagger}$ ($DF^{\ddagger}$) Energy transfer and quenching. 19
1. $HF^{\ddagger}$ ($DF^{\ddagger}$) Energy transfer. 19
a. $HF(v_i = 0) + M^{\ddagger} \rightarrow HF^{\ddagger}(v_j > 0) + M \quad (M \neq HF)$
(Energy transferred to HF from $M^{\ddagger}$). 19
b. $HF^{\ddagger}(v_i = m) + M \rightarrow HF^{(\ddagger)}(v_j < m) + M^{\ddagger} \quad (v_j \geq 0)$
(Energy transferred from $HF^{\ddagger}$ to M). 19
c. $HF(v_i) + HF(v_j) \rightarrow HF(v_k) + HF(v_\ell)$
$(i + j = k + \ell)$ (HF - HF Energy transfer) . . . 20
2. $HF^{\ddagger}$ ($DF^{\ddagger}$) Quenching. 21
a. $HF^{\ddagger}(v_i = m) + M \rightarrow HF^{(\ddagger)}(v_j < m) + M \quad (v_j \geq 0)$
(Collisional quenching) 21
b. $HF^{\ddagger}(v_i = m) + HF \rightarrow HF^{(\ddagger)}(v_j < m) + HF \ (v_j \geq 0)$
(HF - HF self-quenching). 22
c. $HF^{\ddagger}(v_i = m) + M \rightarrow$ prod. (Dissociative quenching) 22
i. $HF^{\ddagger}(v_i = m) + M_2 \rightarrow HF(v_j = 0) + M + M$. . . . 22
ii. $HF^{\ddagger}(v_i = m) + M \rightarrow H + F + M$. 23
C. $HF^{\ddagger}$ ($DF^{\ddagger}$) Theoretical papers 23

Part II. Hydrogen chloride (HCl, DCl). 24
A. Formation of $HCl^{\ddagger}$ ($DCl^{\ddagger}$) 24
1. Bimolecular reactions (Abstraction lasers) 24
a. Abstraction of H (D) atom by Cl atom 24
i. $Cl + H_2 \rightarrow HCl^{\ddagger} + H$ 24
ii. $Cl + HX \rightarrow HCl^{\ddagger} + X$ 24
iii. $Cl + RH \rightarrow HCl^{\ddagger} + R$ 25
b. Abstraction of Cl atom by H (D) atom 25
i. $H + Cl_2 \rightarrow HCl^{\ddagger} + Cl$. 25
ii. $H + ClX \rightarrow HCl^{\ddagger} + X$ 26
iii. $H + RCl \rightarrow HCl^{\ddagger} + R$ 26
iv. $H + HCl \rightarrow HCl^{\ddagger} + H$ 27
2. Unimolecular reactions (Elimination lasers). 27
a. $R_1 + R_2 \rightarrow [R_1R_2]^{*} \rightarrow HCl^{\ddagger} + M$(Chemical activation).27
b. $M_1 + h\nu \rightarrow HCl^{\ddagger} + M_2$ (Photochemical elimination). .27
B. $HCl^{\ddagger}$ ($DCl^{\ddagger}$) Energy transfer and quenching. 27
1. $HCl^{\ddagger}$ ($DCl^{\ddagger}$) Energy transfer. 27
a. $HCl\ (v_i = 0) + M^{\ddagger} \rightarrow HCl^{\ddagger}(v_j > 0) + M \quad (M \neq HCl)$
(Energy transferred to HCl from $M^{\ddagger}$) 27
b. $HCl^{\ddagger}(v_i = m) + M \rightarrow HCl^{(\ddagger)}(v_j < m) + M^{\ddagger}\ (v_j \geq 0)$
(Energy transferred from $HCl^{\ddagger}$ to M) 27
c. $HCl(v_i) + HCl(v_j) \rightarrow HCl(v_k) + HCl(v_\ell)$
$(i + j = k + \ell)$ (HCl - HCl Energy transfer) . . .28
2. $HCl^{\ddagger}$ ($DCl^{\ddagger}$) Quenching. 28
a. $HCl^{\ddagger}(v_i = m) + M \rightarrow HCl^{(\ddagger)}(v_j < m) + M \quad (v_j \geq 0)$
(Collisional quenching) 28
b. $HCl^{\ddagger}(v_i = m) + HCl \rightarrow HCl^{(\ddagger)}(v_j < m) + HCl$
$(v_j \geq 0)$ (HCl - HCl self-quenching) 29
c. $HCl^{\ddagger}(v_i = m) + M_2 \rightarrow HCl(v_j = 0) + M + M$
(Dissociative quenching). 29
C. $HCl^{\ddagger}$ ($DCl^{\ddagger}$) Theoretical papers 30

Part III. Hydrogen bromide (HBr, DBr) 31
A. Formation of $HBr^{\ddagger}$ ($DBr^{\ddagger}$) 31
1. Bimolecular reactions (Abstraction lasers) 31
a. Abstraction of H (D) atom by Br atom 31
i. $Br + H_2 \rightarrow HBr^{\ddagger} + H$ 31
ii. $Br + HX \rightarrow HBr^{\ddagger} + X$ 31
iii. $Br + RH \rightarrow HBr^{\ddagger} + R$ 31
b. Abstraction of Br atom by H (D) atom 31
i. $H + Br_2 \rightarrow HBr^{\ddagger} + Br$ 31
ii. $H + BrX \rightarrow HBr^{\ddagger} + X$ 32
B. $HBr^{\ddagger}$ ($DBr^{\ddagger}$) Energy transfer and quenching 32
1. $HBr^{\ddagger}$ ($DBr^{\ddagger}$) Energy transfer 32
a. $HBr(v_i = 0) + M^{\ddagger} \rightarrow HBr^{\ddagger}(v_j > 0) + M$ $(M \neq HBr)$
(Energy transferred to HBr from $M^{\ddagger}$) 32
b. $HBr^{\ddagger}(v_i = m) + M \rightarrow HBr^{(\ddagger)}(v_j < m) + M^{\ddagger}$ $(v_j \geq 0)$
(Energy transferred from $HBr^{\ddagger}$ to M) 32
c. $HBr(v_i) + HBr(v_j) \rightarrow HBr(v_k) + HBr(v_\ell)$
$(i + j = k + \ell)$ (HBr - HBr Energy transfer) . . . 32
2. $HBr^{\ddagger}$ ($DBr^{\ddagger}$) Quenching 32
a. $HBr^{\ddagger}(v_i = m) + M \rightarrow HBr^{(\ddagger)}(v_j < m) + M$ $(v_j \geq 0)$
(Collisional quenching) 32
b. $HBr^{\ddagger}(v_i = m) + HBr \rightarrow HBr^{(\ddagger)}(v_j < m) + HBr$
$(v_j \geq 0)$ (HBr - HBr self-quenching) 33
C. $HBr^{\ddagger}$ ($DBr^{\ddagger}$) Theoretical papers 33

Part IV. Hydrogen iodide (HI, DI). 34
A. Formation of $HI^{\ddagger}$ ($DI^{\ddagger}$) 34
1. Bimolecular reactions (Abstraction lasers) 34
a. Abstraction of H (D) atom by I atom. 34
i. $I + H_2 \rightarrow HI^{\ddagger} + H$ 34
ii. $I + HX \rightarrow HI^{\ddagger} + X$ 34
iii. $I + RH \rightarrow HI^{\ddagger} + R$ 34
b. Abstraction of I atom by H (D) atom. 34
i. $H + I_2 \rightarrow HI^{\ddagger} + I$ 34
ii. $H + IX \rightarrow HI^{\ddagger} + X$ 34
B. $HI^{\ddagger}$ ($DI^{\ddagger}$) Energy transfer and quenching. 34
1. $HI^{\ddagger}$ ($DI^{\ddagger}$) Energy transfer. 34
a. $HI(v_i = 0) + M^{\ddagger} \rightarrow HI^{\ddagger}(v_j > 0) + M$ $(M \neq HI)$
(Energy transferred to Hl from $M^{\ddagger}$). 34
b. $HI^{\ddagger}(v_i = m) + M \rightarrow HI^{(\ddagger)}(v_j < m) + M^{\ddagger}$ $(v_j \geq 0)$
(Energy transferred from $HI^{\ddagger}$ to M). 35
c. $HI(v_i) + HI(v_j) \rightarrow HI(v_k) + HI(v_\ell)$
$(i + j = k + \ell)$ (HI - HI Energy transfer) 35
2. $HI^{\ddagger}$ ($DI^{\ddagger}$) Quenching. 35
a. $HI^{\ddagger}(v_i = m) + M \rightarrow HI^{(\ddagger)}(v_j < m) + M$ $(v_j \geq 0)$
(Collisional quenching) 35
b. $HI^{\ddagger}(v_i = m) + HI \rightarrow HI^{(\ddagger)}(v_j < m) + HI$ $(v_j \geq 0)$
(HI - HI self-quenching). 35
C. $HI^{\ddagger}$ ($DI^{\ddagger}$) Theoretical papers 35
Part V. Reviews and Bibliographies 36
Part VI. References 37

VIBRATIONALLY EXCITED HYDROGEN HALIDES:

A Bibliography on Chemical Kinetics of Chemi-xcitation and Energy Transfer Processes*

Francis Westley

A bibliography, a reaction oriented list of references, is provided for published papers and reports containing rate data for reactions of halogen atoms with hydrogen-containing compounds, or of H (D, or T) atoms with halogen-containing compounds to form vibrationally chemiexcited hydrogen halides. The reactions for vibroexcitation of hydrogen halides through unimolecular or photochemical elimination, as well as the processes for vibrational energy transfer between hydrogen halides and various second bodies are also included. In addition, four lists of theoretical papers and a list of critical reviews and bibliographies are provided. Over 300 papers covering 50 types of reactions are listed. The period covered extends from 1958 through 1973.

Key words: Bibliography; chemical kinetics; chemiexcitation; gas phase; halogens; hydrogen; hydrogen halides; laser; quenching; vibrational energy transfer.

Introduction

The bibliography lists papers and reports on the gas phase reaction kinetics of two types of chemical processes: a) formation of vibrationally excited hydrogen halides through abstraction or elimination and b) vibrational energy transfer - including quenching - between hydrogen halides and various second bodies.

---

*This publication is an activity of the Chemical Kinetics Information Center, National Bureau of Standards. The work was supported by the Office of Standard Reference Data, National Bureau of Standards and the Air Force Office of Scientific Research as part of a program to provide information and data on rates of chemical reactions.

The articles have been selected from the files of the Chemical Kinetics Information Center. The criterion for inclusion of an article is that it must contain some new information on the reaction. That is, simple quotations of the results of others and ad hoc guesses have been excluded. There are gray areas, such as the statement of a rate calculated from that of the reverse reaction and the equilibrium constant, or information such as: suggestion of a new mechanism, or a theoretical calculation, or a new theoretical approach derived from kinetic experiments. If the information seemed to be important the reference was included.

The two above mentioned types of reactions (formation of vibrationally excited hydrogen halides and transfer of vibrational energy between hydrogen halides and other bodies) are essential in a fairly new branch of quantum electronics: the chemical laser. Light amplification by stimulated emission of radiation (in short: laser) is a fairly recent development in science dealing with the generation of coherent radiation in the infrared and visible regions of the spectrum. The chemical lasers are based on the new principle of obtaining energy - in the form of coherent radiation - from chemical reactions: the principle of "chemical pumping". In other words, chemical interaction between two gaseous molecules results in the pumping of electronic, vibrational, or rotational energy into the newly formed bond of one to the reaction products. The new bond "stores" for a short time an amount of energy available for other uses. Such a reaction, which is only the first elementary step in the more complex lasing process, is called in short "chemiexcitation". The first observation of an infrared emission from the reaction of atomic hydrogen with molecular chlorine, was reported in 1958 by Cashion and Polanyi[1,2]. They attributed this emission to the vibrationally excited hydrogen chloride, which was one of the products of the reaction:

$$H + Cl_2 \rightarrow HCl^{\ddagger}(v \leq 6) + Cl \qquad (1)$$

In 1961, Polanyi suggested the construction of a HCl laser, dependent on vibrational excitation, which would operate in the infrared region[8]. Polanyi and coworkers have continued their pioneering work in the field of chemical lasers, by following a double path: experimental [infrared spectroscopy[3,4,5], energy distribution among reaction products[6,13,14,17,18,29,21,22,23]] and theoretical [energy distribution[7,9,10,12,15,19,23], potential energy surface[11,12,23], trajectories[12,15,23], chemical kinetics[16]]

However, the first description of an operational HCl pulsed chemical laser was published in 1965 by Kasper and Pimentel[24]. In the following years the research on chemical lasers has been continually expanding. A list of the universities and industrial research laboratories, as well as of their scientists carrying out research in chemical lasers can be found in the introduction of a bibliography published in 1972 by the U.S. Atomic Energy Commission [Chemical Lasers: An Overview of the Literature, (1960 - 1971)[25]].

Since 1965, many chemiexcited molecules have been found suitable in the operation of chemical lasers. However, the hydrogen halides are the most used molecules for that purpose. To date, the highest energy level of a chemiexcited hydrogen halide molecule is vibrational. The search of the literature failed to show the existence of a laser based on an electronically excited hydrogen halide molecule. For these reasons, this bibliography is confined only to two types of reactions involving hydrogen halides: a) vibrational chemiexcitation and b) vibrational energy transfer. No attempt was made to cover the literature dealing with the operation of hydrogen halide lasers. The reader interested in operation of chemical lasers should consult the "Comprehensive Literature Survey of Chemical Lasers" by Arnold and Rojeska[26] or the above mentioned bibliography of Dobratz[25], as well as other reviews and bibliographies listed in part V of this work.

This bibliography is not the result of the effort of a single person, but of the whole staff of Chemical Kinetics Information Center. My thanks to all of them.

In particular, I wish to thank Dr. David Garvin, Director of the Center, and Dr. Robert Hampson for their more than helpful suggestions and constant guidance; Mr. James G. Koch, Supervisor, for tracking down and obtaining papers and reports, otherwise very difficult to obtain; Mrs. Ann C. Robertson, Mrs. Geraldine Zumwalt and Miss Darlene Connelly, for typing a difficult manuscript with particular care.

REFERENCES CITED IN THE INTRODUCTORY MATERIAL

1. Cashion, J. K., and Polanyi, J. C., "Infrared Chemiluminiscence from the Gaseous Reaction H· + Cl_2," J. Chem. Phys. 29, 455 (1958)

2. Cashion, J. K., and Polanyi, J. C., "Resolved Infrared Emission Spectrum of the Reaction Atomic H· + Cl_2," J. Chem. Phys. 30, 1097 (1959)

3. Cashion, J. K., and Polanyi, J. C., "Infra-red Chemiluminescence I. Infra-red Emission from Hydrogen Chloride formed in the Systems Atomic Hydrogen plus Chlorine, Atomic Hydrogen plus Deuterium Chloride, and Atomic Deuterium plus Hydrogen Chloride," Proc. Roy. Soc. (London), A 258, 529 (1960)

4. Cashion, J. K., and Polanyi, J. C., "Infra-red Chemiluminescence II. Spectrosopic Data," Proc. Roy. Soc. (London), Series A 258, 564 (1960)

5. Cashion, J. K., and Polanyi, J. C., "Infra-red Chemiluminiscence III. Infra-red Emission from Hydrogen Bromide formed in the Systems Atomic Hydrogen plus Bromine, and Atomic Hydrogen plus Hydrogen Bromide," Proc. Roy. Soc. (London), Series A 258, 570 (1960)

6. Charters, P. E., and Polanyi, J. C., "Energy Distribution among Reaction Products. Part 1. The Reaction Atomic Hydrogen plus Molecular Chlorine," Discussions Faraday Soc. 33, 107 (1962)

7. Polanyi, J. C., "Energy Distribution Among Reagents and Products of Atomic Reactions," J. Chem. Phys. 31, 1338 (1959)

8. Polanyi, J. C., "Proposal for an Infrared Maser Dependent on Vibrational Excitation," J. Chem. Phys. 34, 347 (1961)

9. Polanyi, J. C., "Infrared Chemiluminescence," J. Quant. Spectr. Radiat. Trans. 3, 471 (1963)

10. Polanyi, J. C., and Rosner, S. D., "Energy Distribution Among Products of Exothermic Reaction," J. Chem. Phys. 38, 1028 (1963)

11. Polanyi, J. C., "Vibrational-Rotational Population Inversion," Appl. Optics Suppl. 2, 109 (1965)

12. Kuntz, P. J., Nemeth, E. M., Polanyi, J. C., Rosner, S. D., and Young, C. E., "Energy Distribution Among Products of Exothermic Reactions. II. Repulsive, Mixed, and Attractive Energy Release," J. Chem. Phys. 44, 1168 (1966)

13. Airey, J. R., Getty, R. R., Polanyi, J. C., and Snelling, D. R., "Absolute Efficiency of Conversion of Heat of the Reaction H + Cl_2 into Vibration," J. Chem. Phys. 41, 3255 (1964)

14. Anlauf, K. G., Kuntz, P. J., Maylotte, D. H., Pacey, P. D., and Polanyi, J. C., "Energy Distribution among Reaction Products. Part 2. H + X_2 and X + HY," Discussions Faraday Soc. 44, 183 (1967)

15. Anlauf, K. G., Polanyi, J. C., Wong, W. H., and Woodall, K. B., "Distribution of Reaction Products. III. Cl + HI, Cl + DI," J. Chem. Phys. 49, 5189 (1968)

16. Anlauf, K. G., Maylotte, D. H., Polanyi, J. C., and Bernstein, R. B., "Rates of the Endothermic Reactions HCl + X(X≡I, Cl) as a Function of Reagent Vibration, Rotation, and Translation," J. Chem. Phys. 51, 5716 (1969)

17. Polanyi, J. C., and Tardy, D. C., "Energy Distribution in the Exothermic Reaction F + H_2 and Endothermic Reaction HF + H," J. Chem. Phys. 51, 5717 (1969)

18. Anlauf, K. G., Charters, P. E., Horne, D. S., MacDonald, R. G., Maylotte, D. H., Polanyi, J. C., Skrlac, W. J., Tardy, D. C., and Woodall, K. B., "Translational Energy-Distribution in the Products of Some Exothermic Reactions," J. Chem. Phys. 53, 4091 (1970)

19. Polanyi, J. C., and Woodall, K. B., "Mechanism of Rotational Relaxation," J. Chem. Phys. 56, 1563 (1972)

20. Maylotte, J. C., Polanyi, J. C., and Woodall, K. B., "Energy Distribution among Reaction Products. IV. X + HY (X≡Cl, Br, Y≡Br, I), Cl + DI," J. Chem. Phys. 57, 1547 (1972)

21. Polanyi, J. C., and Woodall, K. B., "Energy Distribution among Reaction Products. VI. F + H_2, D_2," J. Chem. Phys. 57, 1574 (1972)

22. Polanyi, J. C., and Sloan, J. J., "Energy Distribution among Reaction Products. VII. H + F_2," J. Chem. Phys. 57, 4988 (1972)

23. Parr, C. A., Polanyi, J. C., and Wong, W. H., "Distribution of Reaction Products (Theory). VIII. Cl + HI, Cl + DI," J. Chem. Phys. 58, 5 (1973)

24. Kasper, J. V. V., and Pimentel, G. C., "HCl Chemical Laser," Phys. Rev. Letters 14, 352 (1965)

25. Dobratz, B. M., "Chemical Lasers: An Overview of the Literature, 1960 - 1971," U.S. Atomic Energy Commission, UCRL 51285 (Sept. 1972) (National Techn. Information Service)

26. Arnold, S. J., and Rojeska, H., "Chemical Lasers: A Comprehensive Literature Survey," Appl. Opt. 12, 169 (1973)

Arrangement of the report. This bibliography is in six parts:

Part I. Hydrogen fluoride ($HF^{\ddagger}$, or $DF^{\ddagger}$)

Part II. Hydrogen chloride ($HCl^{\ddagger}$, or $DCl^{\ddagger}$)

Part III. Hydrogen bromide ($HBr^{\ddagger}$, or $DBr^{\ddagger}$)

Part IV. Hydrogen iodide ($HI^{\ddagger}$, or $DI^{\ddagger}$)

Part V. Reviews and Bibliographies (Critical reviews, or surveys and general bibliographies dealing with the reactions listed in parts I to IV).

Part VI. The combined bibliography for Parts I to V arranged alphabetically by authors. The complete reference citation for each article mentioned is given here. Occasionally explanatory notes are appended. These establish the "bibliography chain" for closely related papers by the same authors.

Parts I to IV are arranged in the order of their importance: Hydrogen fluoride (Part I) is the most intensively studied chemical laser, while hydrogen iodide (Part IV) is the least studied.

Ordering of chemical reactions. The purpose of this work is to provide the chemical kineticist with a useful list of articles and papers dealing with the vibrationally excited hydrogen halides. For that reason, the arrangement of the bibliography is reaction oriented: parts I to IV are each divided into three large sections:

Section A. Formation of $HX^{\ddagger}$ (X = F, Cl, Br, I)

Section B. $HX^{\ddagger}$ Energy Transfer and Quenching

Section C. $HX^{\ddagger}$ Theoretical Papers

The titles of Sections A and B define very broad categories of reactions. Section C includes only theoretical papers, very closely related to the kinetics of vibrationally excited hydrogen halides. Section A does not include formation of $HX^{\ddagger}$ by energy transfer. This type of reaction may be found in Section B, under 1.a. Each of the Sections A and B is divided into smaller categories of reactions and so on, as indicated in the table of contents.

Display of Chemical Reactions and Formulae. With the exception of subgroups A.1.a and A.1.b, all the other subgroups define a type of chemical reaction. Subgroups A.1.a and A.1.b are each further divided into three types of reactions. For instance, in part I (Hydrogen fluoride) these types are:

A.1.a. Abstraction of H atom by F atom.

$$\text{i.} \quad F + H_2 \rightarrow HF^{\ddagger} + H \qquad (2)$$

$$\text{ii.} \quad F + HX \rightarrow HF^{\ddagger} + X \qquad (3)$$

$$\text{iii.} \quad F + RH \rightarrow HF^{\ddagger} + R \qquad (4)$$

A.1.b. Abstraction of F atom by H atom.

$$\text{i.} \quad H + F_2 \rightarrow HF^{\ddagger} + F \qquad (5)$$

$$\text{ii.} \quad H + FX \rightarrow HF^{\ddagger} + X \qquad (6)$$

$$\text{iii.} \quad H + RF \rightarrow HF^{\ddagger} + R \qquad (7)$$

Throughout the work these different types of reactions are displayed according to a scheme trying to emphasize the direction and nature of the chemical process, rather than to follow a mere alphabetical order. So, the above listed reactions (2) to (7) are all written according to the invariable pattern:

Abstracting atom	+	Molecule	→	Vibrationally excited Product	+	Other Products

In reactions (4) and (7), the terms RH and RF denote in general a hydrogen containing - and, respectively, a halogen containing - organic molecule. However, in some instances, a reference listed under the headings A.1.a.iii. or A.1.b.iii. (Reactions (4) and (7)), might deal with a hydrogen - or halogen - containing inorganic molecule.

The general "third body", whether excited or in ground state, is always last:

$$\text{B.1.a.} \quad HF(v_i=0) + M^{\ddagger} \rightarrow HF^{\ddagger}(v_j>0) + M \quad (M \neq HF) \qquad (8)$$

In general, the first term at the right side of a reaction indicates a vibrationally excited product. The only exception is the reaction type B.2.c (Dissociative quenching).

$$\underline{\text{B.2.c.}}\quad \text{i.}\quad HF^{\ddagger}(v_i=m) + M_2 \rightarrow HF(v_j=0) + M + M \qquad (9)$$

$$\underline{\text{B.2.c.}}\quad \text{ii.}\quad HF^{\ddagger}(v_i=m) + M \rightarrow H + F + M \qquad (10)$$

Excited states of reactants and products. This bibliography deals exclusively with vibrationally excited hydrogen halides. The sign used to indicate the vibronic state of a molecules is the double dagger superscript. If the double dagger appears inside a bracket, it indicates that the molecule might be in its ground state (zero vibrational level):

$$\underline{\text{B.1.b.}}\quad HF^{\ddagger}(v_i=m) + M \rightarrow HF^{\ddagger}(v_j<m) + M^{\ddagger}(v_k>0) \qquad (11)$$

(v_j might be 0)

Only in one instance an asterisk is used to indicate the formation of an intermediate activated complex, which subsequently is dissociated into a vibrationally excited hydrogen halide molecule and another product:

$$\text{A.2.a.}\quad R_1 + R_2 \rightarrow [R_1R_2]^* \rightarrow HX^{\ddagger} + M \quad \text{(Chemical activation)} \qquad (12)$$

Reactions of the type B.1.c. are expressed by a generalized chemical equation including all the HX - HX vibrational energy transfer processes. The multiplicity of vibrational levels (some authors consider 8 vibrational levels in the same paper) would have made it very difficult to arrange this bibliography according to all the possible HX - HX vibronic interactions. Although, in this type of process, four different vibronic levels coexist, the double dagger superscript is entirely omitted and the different vibronic levels are indicated in a bracket following each HX molecule. The reason for omitting the dagger symbol is that only one of the four vibronic levels (v_i, v_j, v_k, v_ℓ) may be zero, provided that the condition $i + j = k + \ell$ is satisfied. (If two, or three of these vibronic levels are zero, then the process becomes a simple quenching, or excitation one.). For the case of the HF - HF vibrational energy transfer, the B.1.c. process is indicated as follows:

$$HF(v_i) + HF(v_j) \rightarrow HF(v_k) + HF(v_\ell) \quad (i + j = k + \ell) \qquad (13)$$

(only one of four levels v_i, v_j, v_k, v_ℓ may be zero)

Reference Citations.

The references under each reaction list the author(s) and the sources, in the following form:

Author(s)	Source-Year-Volume-Page	Number of Author(s)
Airey, J. R.	IJCKBO-1970-2-65	1
Airey and Fried	CHPLBC-1971-8-23	2
Airey, et al.	JCPSA6-1964-41-3255	3 or more

Variations from this format (which we will call "short reference") are usually in the direction of more explicit specification. These variations are never made in the first two fields, source and year. They are fixed and always present.

The sources are indicated by their ASTM CODEN abbreviations*). A guide to these codes follows. As listed in this guide, the codes include an additional sixth cipher, which is a "check character"**). A code prefixed with an asterisk is a code not in the ASTM CODEN set. These are codes we have assigned for reports from industrial laboratories, research institutes and universities. When the CODEN system adopts appropriate codes they will be replaced. The present, temporary codes usually end with Z or U.

---

*) Blumental, J. G., Karaman, M., Editors, "CODEN FOR PERIODICAL TITLES" (Including Non-Periodical Titles and Deleted Coden), Vol. I and II, ASTM Data Series DS 23B, Third Edition, (1970); Padusis, M., Editor, First Supplement to Third Edition, DS 23B-S1 (05-023021-42, 1972). (American Society for Testing and Materials, 1916 Race St., Philadelphia, Pa. 19103)

**) The final sixth character in the journal code is a "check character". This is not shown in the listings in ASTM DS 23B and DS 23B-S1, but the calculation is explained in the introductions to them. See also "Subroutine for the Calculation of CODEN Check Characters, D. Garvin, National Bureau of Standards, Tech. Note 738 (Sept. 1972)

ACHRAY	ACCOUNTS OF CHEMICAL RESEARCH (Washington)
ACIEAY	ANGEWANDTE CHEMIE (International Edition in English)
ACSRAL	AMERICAN CHEMICAL SOCIETY, ABSTRACT OF PAPERS
ADCPAA	ADVANCES IN CHEMICAL PHYSICS (New York)
APOPAI	APPLIED OPTICS (Washington)
APOSAR	APPLIED OPTICS, SUPPLEMENT (Washington)
APPLAB	APPLIED PHYSICS LETTERS (New York)
ARPLAP	ANNUAL REVIEW OF PHYSICAL CHEMISTRY
*ASTSZU	THE AEROSPACE CORPORATION
BBPCAX	BERICHTE DER BUNSENGESELLSCHAFT FUER PHYSIKALISCHE CHEMIE (Germany)
BOOKA7	BOOK
CBFMAO	COMBUSTION AND FLAME
CCHKAZ	COMPREHENSIVE CHEMICAL KINETICS (Amsterdam)
CHDBAN	COMPTES RENDUS HEBDOMADAIRES DES SEANCES DE L'ACADEMIE DES SCIENCES, SERIE B. SCIENCES PHYSIQUES (Paris)
CHMBAY	CHEMISTRY IN BRITAIN (London)
CHPLBC	CHEMICAL PHYSICS LETTERS (Amsterdam)
CITEAH	CHEMIE-INGENIEUR-TECHNIK (Germany)
CJCHAG	CANADIAN JOURNAL OF CHEMISTRY
CSSPAD	CHEMICAL SOCIETY, SPECIAL PUBLICATION (London)
DABBBA	DISSERTATION ABSTRACTS INTERNATIONAL, B. THE SCIENCES AND ENGINEERING
DABSA9	DISSERTATION ABSTRACTS PART B. SCIENCES AND ENGINEERING
DAKEAT	DANSK KEMI (Copenhagen)
DFSOAW	DISCUSSIONS OF FARADAY SOCIETY
DIASA9	DISSERTATION ABSTRACTS
DKPCAG	DOKLADY PHYSICAL CHEMISTRY, PROCEEDINGS OF THE ACADEMY OF SCIENCES OF THE USSR (New York)
HIECAP	HIGH ENERGY CHEMISTRY (New York)
IEJQA7	IEEE JOURNAL OF QUANTUM ELECTRONICS (New York)
IJCKBO	INTERNATIONAL JOURNAL OF CHEMICAL KINETICS (New York)

JAPIAU	JOURNAL OF APPLIED PHYSICS (New York)
JASMAN	JOURNAL OF THE ACOUSTICAL SOCIETY OF AMERICA
JCFTAR	JOURNAL OF CHEMICAL SOCIETY, FARADAY TRANSACTIONS I (London)
JCFTBS	JOURNAL OF CHEMICAL SOCIETY, FARADAY TRANSACTIONS II (London)
JCPQAY	JOURNAL DE CHIMIE PHYSIQUE
JCPSA6	JOURNAL OF CHEMICAL PHYSICS
JCSOA9	JOURNAL OF THE CHEMICAL SOCIETY (London)
JPCHAX	JOURNAL OF PHYSICAL CHEMISTRY
JQSRAE	JOURNAL OF QUANTITATIVE SPECTROSCOPY AND RADIATIVE TRANSFER
JTPLA2	JETP LETTERS, SOVIET PHYSICS (New York)
KICAA8	KINETICS AND CATALYSIS
LSRVAN	LASER FOCUS
MOPHAM	MOLECULAR PHYSICS (London)
NATUAS	NATURE (London)
PACHAS	PURE AND APPLIED CHEMISTRY (London)
PRKNAZ	PROGRESS IN REACTION KINETICS
PRLAAZ	PROCEEDINGS OF ROYAL SOCIETY, SERIES A. MATHEMATICAL AND PHYSICAL SCIENCES (London)
PRLTAO	PHYSICAL REVIEW LETTERS (New York)
PYLAAG	PHYSICS LETTERS, SECTION A (Amsterdam)
QRCSAL	QUARTERLY REVIEW OF THE CHEMICAL SOCIETY (London)
RJPCAR	RUSSIAN JOURNAL OF PHYSICAL CHEMISTRY
SCAMAC	SCIENTIFIC AMERICAN (New York)
SCIEAS	SCIENCE (Washington)
SPHJAR	SOVIET PHYSICS JETP (New York)
SPUSBI	SOVIET PHYSICS - USPEKHI (New York)
SYMCAQ	SYMPOSIUM ON COMBUSTION
TFSOA4	TRANSACTIONS OF THE FARADAY SOCIETY
UCRLAE	UNIVERSITY OF CALIFORNIA, LAWRENCE RADIATION LABORATORY, REPORTS
XADRCH	UNITED STATES DEPARTMENT OF COMMERCE, NATIONAL TECHNICAL INFORMATION SERVICE
XCCIAV	UNITED STATES DEPARTMENT OF COMMERCE, CLEARINGHOUSE FOR SCIENTIFIC AND TECHNICAL INFORMATION

XERLAR	U.S. ATOMIC ENERGY COMMISSION, UNIVERSITY OF CALIFORNIA, RADIATION LABORATORY
ZEPCAC	ZEITSCHRIFT FUER PHYSIKALISCHE CHEMIE, STOECHIOMETRIE UND VERWANDSCHAFTSLIHRE
ZPCBAL	ZEITSCHRIFT FUER PHYSIKALISCHE CHEMIE, ABTEILUNG B: CHEMIE DER ELEMENTARPROZESSE, AUFBAU DER MATERIE
26BMAD	MTP(MEDICAL AND TECHNICAL PUBLISHING COMPANY) INTERNATIONAL REVIEW OF SCIENCE: PHYSICAL CHEMISTRY, SERIES ONE 1972-1973

Abbreviations

The abbreviations listed below, are used in parts I through IV of this bibliography.

(calc.)	= (calculation)
(cr. sect.)	= (cross section)
(d.r.)	= (detailed rates)
(mech.)	= (mechanism)
(model.)	= (modelling)
(pop. distr.)	= (population distribution)
(pot. surf.)	= (potential energy surface)
(r.p.)	= (related paper)
(rev.)	= (review)
(traj.)	= (trajectories)
(trans. prob.)	= (transition probability)

They are appended inside brackets at the end of the short references. In general, a short reference without appended abbreviations indicates a work including rate constants while a reference followed by appended abbreviations may or may not include rate constants.

The abbreviation r.p. (related paper) indicates a paper which cannot fit in any of the above listed categories. For instance, a work dealing with laser operation will be followed by (r.p.) if it is considered of interest. However, a number of papers with rate constants are included in the r.p. category. For instance, under the heading: $Cl + H_2 \rightarrow HCl^{\ddagger} + H$ a number of papers giving rate constants for the overall reaction $Cl + H_2 \rightarrow HCl + H$ are included. In this reaction, the product HCl indicates all molecules of hydrogen chloride whether in the ground state or in an excited state. Such a paper is therefore a very closely related paper.

Part I. Hydrogen fluoride (HF, DF)

A. Formation of $HF^{\ddagger}$ ($DF^{\ddagger}$)

1. Bimolecular Reactions (Abstraction Lasers)

a. Abstraction of H(D) Atom by F Atom

i. $F + H_2 \rightarrow HF^{\ddagger} + H$

Airey, J. R.	IJCKBO-1970-2-65
Anlauf, et al.	JCPSA6-1970-53-4091 (calc., pop. distr.)
Basov, et al.	JTPLA2-1969-9-375 (r. p.)
Beattie, et al.	IEJQA7-1973-9-202 (r.p.)
Ben-Shaul, et al.	JCPSA6-1972-57-5427 (calc., pop. distr.)
Ben-Shaul, et al.	CHPLBC-1972-15-160 (pop. distr.)
Berry, M. J.	ACSRAL-1973-166-Phys. 98
Brokaw, R. S.	JPCHAX-1965-69-2808 (r. p.)
Burmasov, et al.	JTPLA2-1969-10-28 (r. p.)
Chang and Setser	JCPSA6-1973-58-2298 (pop. distr.)
Chester and Hess	IEJQA7-1972-8-1 (rev.)
Clyne, et al.	CJCHAG-1973-51-3596 (r. p.)
Cohen, N.	XADRCA-1972-AD 763715
Cool, et al.	APPLAB-1969-15-318 (r. p.)
Cool, et al.	JAPIAU-1970-41-4038
Coombe and Pimentel	IEJQA7-1973-9-192
Coombe and Pimentel	JCPSA6-1973-59-251
Coombe and Pimentel	JCPSA6-1973-59-1535
Deutsch, T. F.	APPLAB-1967-10-234 (r. p.)
Deutsch, T. F.	APPLAB-1967-11-18 (r. p.)
Dodonov, et al.	DKPCAG-1971-198-440
Dolgov-Savel'ev, et al.	SPHJAR-1970-31-643
Duewer and Setser	JCPSA6-1973-58-2310 (pop. distr.)
Dolgov-Savel'ev, et al.	SPHJAR-1972-34-34
Emanuel, et al.	XADRCA-1972-AD 746685 (rev.)
Fettis and Knox	PRKNAZ-1964-2-2 (r. p.)
Green and Lin	JCPSA6-1971-74-3222 (calc.)
Gregg, et al.	CHPLBC-1971-8-609 (r. p.)
Gross, R. W. F.	JCPSA6-1969-50-1889 (r. p.)
Gross, et al.	JCPSA6-1968-48-3821 (r. p.)
Gross, et al.	JCPSA6-1969-51-1250 (r. p.)
Gross, et al.	IEJQA7-1970-6-168 (r. p.)
Hess, L. D.	IEJQA7-1973-9-201 (r. p.)
Hess, L. D.	JAPIAU-1972-43-1157 (r. p.)
Hess, L. D.	JCPSA6-1971-55-2466
Homann, et al.	BBPCAX-1970-74-585 (r. p.)
Jaffe, et al.	JCPSA6-1973-59-1128 (calc.,pot. surf., traj.)
Jensen and Rice	CHPLBC-1970-7-627 (r. p.)
Jensen and Rice	CHPLBC-1971-8-214 (r. p.)
Jonathan, et al.	MOPHAM-1971-20-93
Jonathan, et al.	APOPAI-1971-10-1821
Kapralova and Chaikin	CBFMAO-1969-13-557 (r. p.)
Kapralova, et al.	KICAA8-1970-11-669 (r. p.)

Kerber, et al.	IEJQA7-1973-9-94 (rev.)
Kerber and Whittier	*ASTSZx-1970-TOR-0059(6753-10)-1
Kompa, K. L.	ACIEAY-1970-9-773 (rev.)
Kompa, K. L.	CITEAH-1970-42-573 (rev.)
Kompa, et al.	CHPLBC-1969-3-210 (r. p.)
Kompa, et al.	JCPSA6-1968-49-4257
Kompa and Pimentel	JCPSA6-1967-47-857
Kompa and Wanner	CHPLBC-1972-12-560
Kompa, et al.	IEJQA7-1970-6-185 (r. p.)
Krogh and Pimentel	JCPSA6-1972-56-969
Kwok, et al.	APPLAB-1970-16-386 (r. p.)
Levine, et al.	CHPLBC-1973-19-1 (pop. distr.)
Levy and Copeland	JPCHAX-1963-67-2156 (r. p.)
Levy and Copeland	JPCHAX-1965-69-408 (r. p.)
Levy and Copeland	JPCHAX-1968-72-3168 (r. p.)
Meinzer, R. A.	IJCKBO-1970-2-335 (r. p.)
Mercer and Pritchard	JPCHAX-1959-63-1468 (r. p.)
Mirels and Spencer	IEJQA7-1971-7-501 (r. p.)
Pan, et al.	CHPLBC-1971-10-577 (r. p.)
Parker and Pimentel	JCPSA6-1969-51-91
Pearson, et al.	IEJQA7-1973-9-723 (r. p.)
Persky, A.	JCPSA6-1973-59-3612 (r. p.)
Pimentel, G. C.	DAKEAT-1969-50-1 (rev.)
Pimentel, G. C.	IEJQA7-1970-6-174 (rev.)
Pimentel, G. C.	PACHAS-1969-18-275 (rev.)
Pummer and Kompa	APPLAB-1972-20-356 (r. p.)
Schafer, et al.	JCPSA6-1970-53-3385
Semenov and Shilov	KICAA8-1964-6-1 (mech.)
Spencer, et al.	IJCKBO-1969-1-493 (r. p.)
Spinnler and Kittle	IEJQA7-1970-6-169 (r. p.)
Suchard, S. N.	JCPSA6-1973-58-1269
Suchard, et al.	APPLAB-1971-19-411 (r. p.)
Suchard, et al.	JCPSA6-1972-57-5065
Suchard, et al.	XADRCA-1973-AD 763716
Vedeneev, et al.	RJPCAR-1969-43-713
Vedeneev, et al.	KICAA8-1969-10-949 (r. p.)
Wilkins, R. L.	JCPSA6-1972-57-912 (calc.,d.r.,pop. distr., pot. surf.,traj.)
Wilkins, R. L.	XADRCA-1971-AD 725031 (calc.)
Wilson and Stephenson	APPLAB-1972-20-64 (r. p.)
Wilson, et al.	IEJQA7-1973-9-202 (r. p.)

ii. $F + HX \rightarrow HF^{\ddagger} + X$

Airey and McKay	APPLAB-1969-15-401 (r. p.)
Berry, M. J.	DABBBA-1971-31-7210
Cool, et al.	JAPIAU-1970-41-4038
Coombe and Pimentel	IEJQA7-1973-9-192
Cool, et al.	APPLAB-1969-15-318 (r. p.)
Green and Lin	IEJQA7-1971-7-98 (r. p.)
Jensen and Rice	CHPLBC-1970-7-627 (r. p.)
Jonathan, et al.	MOPHAM-1971-22-561

Jonathan, et al.	CHPLBC-1970-7-257
Jonathan, et al.	APOPAI-1971-10-1821 (calc.)
Kirsch and Polanyi	JCPSA6-1972-57-4498 (calc.)
Kompa and Wanner	CHPLBC-1972-12-560

iii. $F + RH \rightarrow HF^{\ddagger} + R$

Berry, M. J.	IEJQA7-1973-9-199 (r. p.)
Brus and Lin	JPCHAX-1971-75-2546
Chang and Setser	JCPSA6-1973-58-2298 (pop. distr.)
Chang, et al.	JPCHAX-1971-75-2070
Chang, et al.	CHPLBC-1971-9-587
Clyne, et al.	CJCHAG-1973-51-3596 (r. p.)
Creighton, et al.	IEJQA7-1973-9-200
Duewer and Setser	JCPSA6-1973-58-2310 (pop. distr.)
Fettis, et al.	JCSOA9-1960-1064 (r. p.)
Green and Lin	JCPSA6-1971-54-3222
Gregg, et al.	CHPLBC-1971-8-609
Jacobson and Kimbell	CHPLBC-1971-8-309 (r. p.)
Jacobson and Kimbell	JAPIAU-1971-42-3402 (r. p.)
Johnson, et al.	JPCHAX-1973-77-2499 (calc.,pop. distr., pot. surf.,traj.)
Jonathan, et al.	MOPHAM-1971-20-93
Jonathan, et al.	APOPAI-1971-10-1821
Kapralova, et al.	KICAA8-1970-11-669 (r. p.)
Kim and Setser	ACSRAL-1973-166-Phys. 99
Kim and Setser	JPCHAX-1973-77-2493 (pop. distr.)
Kompa, et al.	CHPLBC-1969-3-210 (r. p.)
Kompa and Wanner	CHPLBC-1972-12-560
Krogh and Pimentel	JCPSA6-1972-56-969
Lin and Green	JCPSA6-1970-53-3383
Mercer and Pritchard	JPCHAX-1959-63-1468 (r. p.)
Molina and Pimentel	IEJQA7-1973-9-64
Padrick and Pimentel	APPLAB-1972-20-167
Parker and Pimentel	IEJQA7-1970-6-175
Parker and Pimentel	JCPSA6-1968-48-5273 (r. p.)
Parker and Pimentel	JCPSA6-1971-55-857
Pimentel, G. C.	DAKEAT-1969-50-1 (rev.)
Pimentel, G. C.	IEJQA7-1970-6-174 (rev.)
Suchard and Pimentel	APPLAB-1971-18-530
Vedeneev, et al.	KICAA8-1963-4-278 (r. p.)

b. Abstraction of F Atom by H(D) Atom

i. $H + F_2 \rightarrow HF^{\ddagger} + F$

Airey, J. R.	IJCKBO-1970-2-65
Albright, et al.	JCPSA6-1969-50-3632
Basov, et al.	JTPLA2-1969-9-375 (r. p.)
Burmasov, et al.	JTPLA2-1969-10-28 (r. p.)
Cohen, N.	XADRCA-1972-AD 763715
Cool, et al.	APPLAB-1969-15-318 (r. p.)
Cool, et al.	JAPIAU-1970-41-4038
Dodonov, et al.	KICAA8-1970-11-677

Emanuel, et al.	XADRCA-1972-AD 746685 (rev.)
Hess, L. D.	JCPSA6-1971-55-2466
Jonathan, et al.	JCPSA6-1970-53-4396 (r. p.)
Jonathan, et al.	APOPAI-1971-10-1821 (calc.)
Jonathan, et al.	MOPHAM-1972-24-1143 (calc.,pot. surf., traj.)
Kapralova and Chaikin	CBFMAO-1969-13-557 (mech.)
Kerber, et al.	IIEJQA7-1973-9-94 (rev.)
Kerber and Whittier	*ASTSZx-1970-TOR-0059(6753-10)-1
Kompa, K. L.	CITEAH-1970-42-573 (rev.)
Levy and Copeland	JPCHAX-1963-67-2156 (mech.)
Levy and Copeland	JPCHAX-1965-69-408 (r. p.)
Levy and Copeland	JPCHAX-1968-72-3168 (r. p.)
Mayer, et al.	SYMCAQ-1967-11-837 (r. p.)
O'Neil, et al.	JCPSA6-1973-58-1126 (calc.,pot. surf.)
Polanyi and Sloan	JCPSA6-1972-57-4988 (calc.,d.r.)
Semenov and Shilov	KICAA8-1964-6-1 (mech.)
Slootmaekers and Van Tiggelen	BSCBAG-1958-67-135 (r. p.)
Suchard, et al.	APPLAB-1971-19-411 (r. p.)
Suchard, et al.	JCPSA6-1972-57-5065
Suchard, et al.	XADRCA-1973-AD 763716
Tal'roze, et al.	KICAA8-1970-11-233
Vedeneev, et al.	KICAA8-1963-4-278 (r. p.)
Vedeneev, et al.	RJPCAR-1969-43-713
Wilkins, R. L.	JCPSA6-1973-58-2326 (calc.,d.r.,pot.surf., traj.)
Wilkins, R. L.	XADRCA-1971-AD 725031 (calc.)
Wilson and Stephenson	APPLAB-1972-20-64 (r. p.)

ii. $H + FX \rightarrow HF^{\ddagger} + X$

Krogh and Pimentel	JCPSA6-1972-56-969
Mayer, et al.	SYMCAQ-1967-11-837 (r. p.)
Pimentel, G. C.	JCPSA6-1973-58-1270 (r. p.)

iii. $H + RF \rightarrow HF^{\ddagger} + R$

Cross, J. B.	JCPSA6-1973-59-966 (r. p.)
Gensel, et al.	CHPLBC-1970-5-179 (r. p.)
Herbelin and Cohen	CHPLBC-1973-20-605 (r. p.)
Krogh and Pimentel	JCPSA6-1972-56-969
Perona, M. J.	JCPSA6-1971-54-4024
Pimentel, G. C.	JCPSA6-1973-58-1270 (r. p.)
Rabideau, S. W.	JCPSA6-1973-59-1533

2. Unimolecular Reactions (elimination lasers)

a. $R_1 + R_2 \rightarrow [R_1R_2]^* \rightarrow HF^{\ddagger} + M$ (chemical activation)

Berry, M. J.	DABBBA-1971-31-7210
Berry and Pimentel	IEJQA7-1970-6-176
Berry and Pimentel	JCPSA6-1968-49-5190

Brus and Lin	JPCHAX-1971-75-2546
Clough, et al.	CJCHAG-1970-48-2919
Cuellar-Ferreira and Pimentel	IEJQA7-1973-9-201
Gordon and Lin	ACSRAL-1973-166-Phys. 137
Lin, M. C.	IEJQA7-1973-9-200 (r. p.)
Lin, M. C.	JPCHAX-1971-75-3642
Padrick and Pimentel	APPLAB-1972-20-167
Padrick and Pimentel	JCPSA6-1971-54-720
Pimentel, G. C.	IEJQA7-1970-6-174 (rev.)
Roebber and Pimentel	IEJQA7-1973-9-201 (r. p.)
Ross and Shaw	JPCHAX-1971-75-1170 (r. p.)

b. $M_1 + h\nu \rightarrow HF^{\ddagger} + M_2$ (photochemical elimination)

Berry, M. J.	DABBBA-1971-31-7210
Berry and Pimentel	IEJQA7-1970-6-176
Berry and Pimentel	JCPSA6-1969-51-2274 (r. p.)
Klimek and Berry	ACSRAL-1973-166-Phys. 103
Klimek and Berry	CHPLBC-1973-20-141
Kompa, K. L.	ACIEAY-1970-9-773 (rev.)
Pimentel, G. C.	IEJQA7-1970-6-174 (rev.)

B. $HF^{\ddagger}(DF^{\ddagger})$ Energy Transfer and Quenching

1. $HF^{\ddagger}(DF^{\ddagger})$ Energy Transfer

a. $HF(v_i = 0) + M^{\ddagger} \rightarrow HF^{\ddagger}(v_j > 0) + M$ $(M \neq HF)$ (energy transferred to HF from $M^{\ddagger}$)

Hancock and Green	JCPSA6-1972-56-2474
Heydtmann, et al.	APOPAI-1971-10-1755
Suchard, et al.	XADRCA-1973-AD 763716

b. $HF^{\ddagger}(v_i = m) + M \rightarrow HF^{(\ddagger)}(v_j < m) + M^{\ddagger}$ $(v_j \geq 0)$
(energy transferred from $HF^{\ddagger}$ to M)

Ahl and Cool	JCPSA6-1973-58-5540
Basov, et al.	APOPAI-1971-10-1814
Basov, et al.	JTPLA2-1969-9-375 (r. p.)
Basov, et al.	IEJQA7-1970-6-183 (r. p.)
Berend and Thommarson	IEJQA7-1973-9-195
Berend and Thommarson	XADRCA-1973-AD 763817
Blauer, et al.	SYMCAQ-1971-13-109
Blauer, et al.	JCPSA6-1972-57-3277
Bott and Cohen	JCPSA6-1973-58-4539
Bott and Cohen	JCPSA6-1973-59-447
Chester, A. N.	JCPSA6-1970-53-3595 (r. p.)
Cohen, N.	XADRCA-1972-AD 763715
Cohen, et al.	IEJQA7-1970-6-168 (r. p.)
Cool, et al.	APPLAB-1969-15-318 (r. p.)
Cool, et al.	JAPIAU-1970-41-4038

Dillon and Stephenson	JCPSA6-1973-58-2056 (calc.,cr.sect.)
Falk, T. J.	XCCIAV-1972-AD 745450
Green and Hancock	IEJQA7-1973-9-50
Gross, R. W. F.	JCPSA6-1969-50-1889 (r. p.)
Hancock and Green	JCPSA6-1972-56-2474
Hancock and Green	JCPSA6-1972-57-4515
Herbelin and Cohen	CHPLBC-1973-20-605 (r. p.)
Hinchen, J. J.	JCPSA6-1973-59-233
Kapralova, et al.	DKPCAG-1971-197-281 (calc.)
Kapralova, et al.	DKPCAG-1971-198-452 (r. p.)
Kerber, et al.	IEJQA7-1973-9-94 (rev.)
Kerber, et al.	IEJQA7-1973-9-190 (r. p.)
Kerber and Whittier	*ASTSZx-1970-TOR-0059(6753-10)-1 (calc.)
Sentman, L. H.	CHPLBC-1973-18-493 (calc.)
Sentman and Solomon	JCPSA6-1973-59-89 (calc.)
Stephens and Cool	JCPSA6-1972-56-5863
Suchard, et al.	JCPSA6-1972-57-5065
Vasil'ev, et al.	SPHJAR-1972-34-51
Vedeneev, et al.	RJPCAR-1969-43-713
Vedeneev, et al.	KICAA8-1970-11-26 (rev.)

c. $HF(v_i) + HF(v_j) \rightarrow HF(v_k) + HF(v_l)$ $(i + j = k + 1)$

(HF – HF energy transfer)

Ahl and Cool	JCPSA6-1973-58-5540
Berend and Thommarson	XADRCA-1973-AD 763817
Bott, J. F.	IEJQA7-1973-9-189
Bott, J. F.	JCPSA6-1972-57-96
Bott and Cohen	JCPSA6-1973-59-447
Cohen, N.	XADRCA-1972-AD 763715
Emanuel, et al.	XADRCA-1972-AD 746685 (rev.)
Green and Hancock	IEJQA7-1973-9-50
Hinchen, J. J.	JCPSA6-1973-59-233
Kerber, et al.	IEJQA7-1973-9-190
Kerber and Whittier	*ASTSZx-1970-TOR-0059(6753-10)-1
Kerber, et al.	IEJQA7-1973-9-94 (rev.)
Kompa, et al.	JCPSA6-1968-49-4257
Osgood, et al.	IEJQA7-1973-9-190
Osgood, et al.	APPLAB-1972-20-469
Sentman, L. H.	CHPLBC-1973-18-493 (calc.)
Suchard, et al.	JCPSA6-1972-57-5065
Suchard, et al.	XADRCA-1973-AD 763716

2. $HF^{\ddagger}(DF^{\ddagger})$ Quenching

a. $HF^{\ddagger}(v_i = m) + M \rightarrow HF^{\ddagger}(v_j < m) + M \ (v \geq 0)$
(collisional quenching)

Ahl and Cool	JCPSA6-1973-58-5540
Airey, J. R.	IJCKBO-1970-2-65
Airey and Fried	CHPLBC-1971-8-23
Airey and Smith	JCPSA6-1972-57-1669
Anlauf, et al.	JCPSA6-1973-58-5354
Berend and Thommarson	IEJQA7-1973-9-195
Berend and Thommarson	JCPSA6-1973-58-3454 (calc.,traj.)
Blair, et al.	JCPSA6-1973-59-1582
Blauer and Solomon	IJCKBO-1973-5-553
Blauer and Solomon	SYMCAQ-1973-14-189
Blauer, et al.	IJCKBO-1972-4-293
Blauer, et al.	XCCIAV-1972-AD 738296
Bott and Cohen	JCPSA6-1971-55-3698
Bott and Cohen	JCPSA6-1971-55-51 4
Bott and Cohen	JCPSA6-1973-58-934
Bott and Cohen	JCPSA6-1973-58-4539
Brokaw, R. S.	JPCHAX-1965-69-2488
Cohen, N.	XADRCA-1972-AD 763715
Emanuel, et al.	XADRCA-1972-AD 746685 (rev.)
Fried, et al.	IEJQA7-1973-9-59
Green and Hancock	IEJQA7-1973-9-50
Hancock and Green	JCPSA6-1972-56-2474
Hancock and Green	JCPSA6-1972-57-4515
Hess, L. D.	IEJQA7-1973-9-201 (r. p.)
Hinchen, J. J.	IEJQA7-1973-9-196
Hinchen, J. J.	JCPSA6-1973-59-233
Just and Rimpel	IEJQA7-1973-9-196
Kapralova and Chaikin	CBFMAO-1969-13-557
Kapralova, et al.	KICAA8-1969-10-23
Kapralova, et al.	CHPLBC-1968-2-581 (calc.,trans. prob.)
Kapralova, et al.	KICAA8-1964-6-884
Kerber, et al.	IEJQA7-1973-9-190 (r. p.)
Kerber and Whittier	*ASTSZx-1970-TOR-0059(6753-10)-1
Kerber, et al.	IEJQA7-1973-9-94 (rev.)
Kompa, et al.	JCPSA6-1968-49-4257
Kwok, M. A.	IEJQA7-1973-9-196
Molina and Pimentel	IEJQA7-1973-9-64
Parker, J. V.	IEJQA7-1973-9-189
Sentman, L. H.	CHPLBC-1973-18-493 (calc.)
Shin, H. K.	CHPLBC-1972-14-64 (calc.)
Suchard, et al.	JCPSA6-1972-57-5065
Suchard, et al.	XADRCA-1973-AD 763715
Thompson, D. L.	JCPSA6-1972-57-4164 (calc.,pot surf.,traj.)
Thompson, D. L.	JCPSA6-1972-57-4170 (calc.,traj.)
Wilkins, R. L.	JCPSA6-1973-58-3038 (calc.,pop. distr., pot.surf.,traj.)
Wilkins, R. L.	JCPSA6-1973-59-698

b. $HF^{\ddagger}(v_i = m) + HF \rightarrow HF^{(\ddagger)}(v_j < m) + HF(v_j \geq 0)$
(HF - HF self-quenching)

Ahl and Cool	JCPSA6-1973-58-5540
Airey and Fried	CHPLBC-1971-8-23
Airey and Smith	JCPSA6-1972-57-1669
Berend and Thommarson	IEJQA7-1973-9-195
Berend and Thommarson	JCPSA6-1973-58-3203
Blair, et al.	JCPSA6-1973-59-1582
Blauer, et al.	SYMCAQ-1971-13-109
Bott, J.	IEJQA7-1973-9-189
Bott and Cohen	JCPSA6-1971-55-3698
Bott and Cohen	JCPSA6-1973-58-934
Bott and Cohen	JCPSA6-1973-58-4539
Emanuel, et al.	XADRCA-1972-AD 746685
Falk, T. J.	XCCIAV-1972-AD 745450
Fried, et al.	IEJQA7-1973-9-59
Green and Hancock	IEJQA7-1973-9-50
Hancock and Green	JCPSA6-1972-56-2474
Hancock and Green	JCPSA6-1972-57-4515
Hinchen, J. J.	IEJQA7-1973-9-196
Hinchen, J. J.	JCPSA6-1973-59-233
Just and Rimpel	IEJQA7-1973-9-196
Kompa, et al.	JCPSA6-1968-49-4257
MacLean and Tregay	XADRCA-1971-AD 732927
Molina and Pimentel	IEJQA7-1973-9-64
Sentman, L. H.	CHPLBC-1973-18-493 (calc.)
Shin, H. K.	CHPLBC-1971-10-81 (calc.)
Shin, H. K.	JCPSA6-1973-59-879 (calc.)
Solomon, et al.	IJCKBO-1971-3-215
Stephens and Cool	JCPSA6-1972-56-5863
Suchard, et al.	JCPSA6-1972-57-5065
Tal'roze, et al.	KICAA8-1970-11-233
Thompson, D. L.	JCPSA6-1972-57-2589
Vasil'ev, et al.	DKPCAG-1970-191-296

c. $HF^{\ddagger}(v_i = m) + M \rightarrow$ products (dissociative quenching)

i. $HF^{\ddagger}(v_i = m) + M_2 \rightarrow HF(v_j = 0) + M + M$

Airey, J. R.	IJCKBO-1970-2-65
Basov, et al.	JTPLA2-1969-9-375 (r. p.)
Brokaw, R. S.	JCPSA6-1965-69-2488
Kapralova and Chaikin	CBFMAO-1969-13-557
Kapralova and Chaikin	KICAA8-1969-10-195 (r. p.)
Kapralova, et al.	DKPCAG-1971-198-452 (r. p.)
Kapralova, et al.	KICAA8-1969-10-23
Kapralova, et al.	KICAA8-1963-4-567 (r. p.)
Kapralova, et al.	KICAA8-1964-6-884
Kompa, K. L.	ACIEAY-1970-9-773 (rev.)
Tal'roze, et al.	KICAA8-1970-11-233
Vasil'ev, et al.	DKPCAG-1970-191-296

ii. $HF^{\ddagger}(v_i = m) + M \rightarrow H + F + M$

MacLean and Tregay SYMCAQ-1973-14-157

C. $HF^{\ddagger}$ ($DF^{\ddagger}$) Theoretical papers

Anlauf, et al. JCPSA6-1970-53-4091 (pop. distr.)
Ben-Shaul, et al. JCPSA6-1972-57-5427 (calc.,pop. distr.)
Ben-Shaul, et al. CHPLBC-1972-15-160 (pop. distr.)
Berend and Thommarson JCPSA6-1973-58-3454 (calc.,traj.)
Blais and Truhlar JCPSA6-1973-58-1090 (pot. surf.,traj.)
Dillon and Stephenson JCPSA6-1973-58-2056 (calc.,cr. sect.)
Emanuel and Whittier APOPAI-1972-11-2047 (calc.)
Jaffe and Anderson JCPSA6-1971-54-2224 (pot. surf.,traj.)
Jaffe, et al. JCPSA6-1973-59-1128 (pot. surf.,traj.)
Jonathan, et al. MOPHAM-1972-24-1143 (pop. distr., pot. surf.,traj.)
Kapralova, et al. CHPLBC-1968-2-581 (trans. prob.)
Kerber, et al. APOPAI-1972-11-1112 (pop distr.,model.)
Levine, et al. CHPLBC-1973-19-1 (pop. distr.)
Muckerman, J. T. JCPSA6-1971-54-1155 (traj.)
Muckerman, J. T. JCPSA6-1972-56-2997 (pot. surf.,traj.)
Muckerman, J. T. JCPSA6-1972-57-3388 (pop. distr.,traj.)
Muckerman and Newton JCPSA6-1972-56-3191 (pot. surf.)
O'Neil, et al. JCPSA6-1973-58-1126 (calc.,pot. surf.)
Polanyi and Sloan JCPSA6-1972-57-4988 (d. r.)
Polanyi and Tardy JCPSA6-1969-51-5717 (pop. distr.)
Polanyi and Woodall JCPSA6-1972-57-1574 (d. r.)
Schatz, et al. JCPSA6-1973-58-4023 (pop. distr.)
Thompson, D. L. JCPSA6-1972-57-4164 (calc.,pot. surf. traj.)
Thompson, D. L. JCPSA6-1972-57-4170 (calc.,traj.)
Thruhlar, D. G. JCPSA6-1972-56-3189 (pot. surf.)
Wilkins, R. L. JCPSA6-1972-57-912 (calc.,pop. distr., pot. surf.,traj.)
Wilkins, R. L. JCPSA6-1973-58-3038 (calc.,pop. distr. pot. surf.,traj.)
Wilkins, R. L. JCPSA6-1973-58-2326 (calc.,pop. distr., pot. surf.,traj.)
Wilkins, R. L. JCPSA6-1973-59-698 (calc.,d.r.,pop. distr., pot. surf.,traj.)

Part II. Hydrogen chloride (HCl, DCl)

A. Formation of $HCl^{\ddagger}$ ($DCl^{\ddagger}$)

1. Bimolecular reactions (abstraction lasers)

a. Abstraction of H(D) atom by Cl atom

i. $Cl + H_2 \rightarrow HCl^{\ddagger} + H$

Ashmore, P. G.	TFSOA4-1953-49-251 (r. p.)
Ashmore and Chanmugam	TFSOA4-1953-49-254 (r. p.)
Benson, et al.	IJCKBO-1969-1-29 (r. p.)
Clyne and Walker	JCFTAR-1973-69-1547 (r. p.)
Corneil, P. H.	DABSA9-1968-28-4524
Corneil and Kasper	IEJQA7-1970-6-170
Corneil and Pimentel	JCPSA6-1968-49-1379
Davis, et al.	IJCKBO-1970-2-101 (r. p.)
Deutsch, T. F.	APPLAB-1967-10-234 (r. p.)
Deutsch, T. F.	APPLAB-1967-11-13 (r. p.)
Deutsch, T. F.	IEJQA7-1967-3-419 (r. p.)
Fettis and Knox	PRKNAZ-1964-2-2 (r. p.)
Galante and Gislason	CHPLBC-1973-18-231 (r. p.)
Henry, et al.	CHDBAN-1968-267-616
Johnson, et al.	JCPSA6-1970-52-6372
Klein, et al.	JCPSA6-1964-41-1799
Kompa, K. L.	CITEAH-1970-42-573 (rev.)
Norrish, R. G. W.	PRLAAZ-1967-301-1 (r. p.)
Pimentel, G. C.	SCAMAC-1966-214-32 (r. p.)
Raff, et al.	JCPSA6-1970-53-1606
Shizgal and Karplus	JCPSA6-1971-54-4357 (r. p.)
Snider, N. S.	JCPSA6-1970-53-4116 (r. p.)
Stedman, et al.	CHPLBC-1970-7-173
Truhlar, D. G.	JCPSA6-1972-56-3189 (r. p.)
Westenberg, A. A.	JCPSA6-1970-53-4117 (r. p.)
Westenberg and de Haas	JCPSA6-1968-48-4405 (r. p.)
Wood, G. O.	JCPSA6-1972-56-1723 (r. p.)
Wood and Chang	APPLAB-1972-20-77 (r. p.)
Yaakov, et al.	JCPSA6-1973-59-2415 (r. p.)

ii. $Cl + HX \rightarrow HCl^{\ddagger} + X$

Airey, J. R.	IEJQA7-1967-3-208 (r. p.)
Airey, J. R.	IEJQA7-1970-6-175
Airey, J. R.	JCPSA6-1970-52-156
Anlauf, et al.	JCPSA6-1970-53-4091
Anlauf, et al.	DFSOAW-1967-44-183 (pop. distr.)
Anlauf, et al.	PYLAAG-1967-24-208 (pop. distr.)
Anlauf, et al.	JCPSA6-1968-49-5189 (calc.)
Ben-Shaul, et al.	CHPLBC-1972-15-160 (pop. distr.)
Ben-Shaul, et al.	JCPSA6-1972-57-5427 (calc.)
Blauer, et al.	XADRCA-1972-AD 738296
Chester, A. N.	JCPSA6-1970-53-3595
Cool, et al.	APPLAB-1969-15-318 (r. p.)

Cool, et al.	IJCKBO-1969-1-495 (r. p.)
Cool, et al.	JAPIAU-1970-41-4038 (r. p.)
Cowley, et al.	CHPLBC-1971-12-144
Glaze, et al.	APPLAB-1971-18-173 (r. p.)
Kompa, K. L.	ACIEAY-1970-9-773 (rev.)
Levine, et al.	CHPLBC-1973-19-1 (pop. distr.)
Maylotte, et al.	JCPSA6-1972-57-1547
Moore, C. B.	IEJQA7-1968-4-52 (r. p.)
Moore and Zittel	SCIEAS-1973-182-541 (rev.)
Naegeli and Ultee	CHPLBC-1970-6-121 (r. p.)
Pimentel, G. C.	PACHAS-1969-18-275 (rev.)
Polanyi, J. C.	APOSAR-1965-2-109 (theory)
Polanyi and Woodall	JCPSA6-1972-56-1563 (calc.)

iii. $Cl + RH \rightarrow HCl^{\ddagger} + R$

Clyne and Walker	JCFTAR-1973-69-1547 (r. p.)
Davis, et al.	IJCKBO-1970-2-101 (r. p.)
Fettis and Knox	PRKNAZ-1964-2-2 (r. p.)
Knox and Nelson	TFSOA4-1959-55-937

b. Abstraction of Cl Atom by H(D) Atom

i. $H + Cl_2 \rightarrow HCl^{\ddagger} + Cl$

Airey, J. R.	IJCKBO-1970-2-65
Airey, et al.	CJCHAG-1964-42-2193
Airey, et al.	JCPSA6-1964-41-3255
Albright, et al.	JCPSA6-1969-50-3632
Anlauf, K. G.	DABBBA-1970-31-1195 (calc.,pop. distr.)
Anlauf, et al.	JCPSA6-1970-53-4091 (calc.,pop. distr.)
Anlauf, et al.	JCPSA6-1972-57-1561 (d. r.)
Anlauf, et al.	DFSOAW-1967-44-183 (pop. distr.)
Anlauf, et al.	PYLAAG-1967-24-208 (pop. distr.)
Ashmore, P. G.	TFSOA4-1953-49-251 (mech.)
Basov, et al.	JTPLA2-1969-9-147 (rev.)
Ben-Shaul, et al.	JCPSA6-1972-57-5427 (calc.,pop. distr.)
Bowen and Overholser	ASACAW-1969-14-475 (pop. distr.)
Cabre and Henry	JCPQAY-1967-64-119 (pop. distr.)
Cabre and Henry	CHDBAN-1969-269-46 (pop. distr.)
Charters, et al.	NATUAS-1962-193-367 (r. p.)
Cashion and Polanyi	JCPSA6-1958-29-455 (r. p.)
Cashion and Polanyi	JCPSA6-1959-30-1097 (pop. distr.)
Cashion and Polanyi	JCPSA6-1961-35-600
Cashion and Polanyi	PRLAAZ-1960-258-529 (pop. distr.)
Cashion and Polanyi	PRLAAZ-1960-258-564 (r. p.)
Charters and Polanyi	DFSOAW-1962-33-107 (pop. distr.)
Chester, A. N.	JCPSA6-1970-53-3595 (calc.,pop. distr.)
Cool, et al.	APPLAB-1969-15-318 (r. p.)
Cool, et al.	JAPIAU-1970-41-4038 (r. p.)
Corneil and Kasper	IEJQA7-1970-6-170
Dodonov, et al.	KICAA8-1970-11-677

Fass, et al.	JPCHAX-1972-76-2801 (r. p.)
Henry, et al.	CHDBAN-1968-267-616
Kasper, J. V. V.	DIASA9-1966-26-5062 (r. p.)
Kasper and Pimentel	PRLTAO-1965-14-352
Klein and Wolfsberg	JCPSA6-1961-34-1494 (r. p.)
Kompa, K. L.	CITEAH-1970-42-573 (rev.)
Levine, et al.	CHPLBC-1973-19-1 (pop. dist.)
Mayer, et al.	SYMCAQ-1967-11-837 (r. p.)
Ménard-Bourcin, et al.	CHDBAN-1972-274-241 (pop. distr.)
Miller and Light	JCPSA6-1971-54-1643 (calc.,pot. surf.)
Moore, C. B.	IEJQA7-1968-4-52 (r. p.)
Norrish, R. G. W.	PRLAAZ-1967-301-1 (r. p.)
Pacey and Polanyi	APOPAI-1971-10-1725
Perona, et al.	JCPSA6-1970-52-6384
Pimentel, G. C.	DAKEAT-1969-50-1 (rev.)
Pimentel, G. C.	IEJQA7-1970-6-174 (rev.)
Pimentel, G. C.	PACHAS-1969-18-275 (rev.)
Pimentel, G. C.	SCAMAC-1966-214-32 (r. p.)
Polanyi, J. C.	APOSAR-1965-2-109 (calc.,pop. distr.)
Polanyi, J. C.	CHMBAY-1966-2-151 (rev.)
Polanyi, J. C.	DFSOAW-1962-33-279 (r. p.)
Polanyi, J. C.	IEJQA7-1970-6-168 (r. p.)
Polanyi, J. C.	JCPSA6-1959-31-1338 (rev.)
Polanyi, J. C.	JCPSA6-1961-34-347 (calc.,pop. distr.)
Polanyi, J. C.	JQSRAE-1963-3-471 (rev.)
Polanyi and Rosner	JCPSA6-1963-38-1028 (r. p.)
Polanyi and Woodall	JCPSA6-1972-56-1563 (cal .,pop. distr.)
Rice and Jensen	IEJQA7-1973-9-199
Russell and Light	JCPSA6-1969-51-1720 (calc.,pop. distr., traj.)
Semenov and Shilov	KICAA8-1964-6-1 (r. p.)
Slootmaekers and Van Tiggelen	BSCBAG-1958-67-135 (r. p.)
Spinnler and Kittle	IEJQA7-1970-6-169 (r. p.)
Stedman, et al.	CHPLBC-1970-7-173
Wilkins, R. L.	JCPSA6-1965-42-806 (r. p.)
Wagner and Wolfrum	ACIEAY-1971-10-604 (rev.)

ii. $H + ClX \rightarrow HCl^{\ddagger} + X$

Anlauf, et al.	JCPSA6-1970-53-4091 (calc.pop. distr.)
Krogh and Pimentel	JCPSA6-1972-56-969
Mayer, et al.	SYMCAQ-1967-11-837 (r. p.)

iii. $H + RCl \rightarrow HCl^{\ddagger} + R$

Anlauf, K. G.	DABBBA-1970-31-1195 (pop. distr.)
Charters, et al.	NATUAS-1962-193-367 (r. p.)
Cabre and Henry	CHDBAN-1969-269-46 (pop. distr.)
Cashion and Polanyi	JCPSA6-1961-35-600
Freeman and Phillips	JPCHAX-1968-72-3031 (r. p.)
Henry, et al.	CHDBAN-1968-267-616
Heydtmann and Polanyi	APOPAI-1971-10-1738 (pop. distr.)

Johnson, R. L.	DABBBA-1969-30-2632 (pop. distr.)
Johnson, et al.	JCPSA6-1970-52-6372 (pop. distr.)
Johnson and Setser	CHPLBC-1969-3-207 (pop. distr.)
Lin, M. C.	CHPLBC-1970-7-209 (mech.)
Ménard-Bourcin, et al.	CHDBAN-1972-274-241 (pop. distr.)
Perona, et al.	JCPSA6-1970-52-6384
Perona, et al.	JPCHAX-1969-73-2091
Rabideau, S. W.	JCPSA6-1973-59-1533
Rice and Jensen	IEJQA7-1973-9-199

iv. $H + HCl \rightarrow HCl^{\ddagger} + H$

Cashion and Polanyi	PRLAAZ-1960-258-529 (pop. distr.)
Wood, G. O.	JCPSA6-1972-56-1723 (r. p.)

2. Unimolecular Reactions (elimination lasers)

a. $R_1 + R_2 \rightarrow [R_1R_2]^* \rightarrow HCl^{\ddagger} + M$ (chemical activation)

Berry and Pimentel	IEJQA7-1970-6-176
Chang, et al.	JPCHAX-1971-75-2070 (pop. distr.)
Lin, M. C.	IEJQA7-1973-9-200 (r. p.)

b. $M_1 + h\nu \rightarrow HCl^{\ddagger} + M_2$ (photochemical elimination)

Berry, M. J.	DABBBA-1971-31-7210
Berry and Pimentel	IEJQA7-1970-6-176
Berry and Pimentel	JCPSA6-1969-51-2274
Berry and Pimentel	JCPSA6-1970-53-3453
Molina and Pimentel	IEJQA7-1973-9-64
Molina and Pimentel	JCPSA6-1972-56-3988

B. $HCl^{\ddagger}(DCl^{\ddagger})$ Energy Transfer and Quenching

1. $HCl^{\ddagger}$ ($DCl^{\ddagger}$) Energy transfer

a. $HCl\ (v_i = 0) + M^{\ddagger} \rightarrow HCl^{\ddagger}(v_j > 0) + M \quad (M \neq HCl)$

(energy transferred to HCl from $M^{\ddagger}$)

Ahl and Cool	JCPSA6-1973-58-5540
Blauer, et al.	JCPSA6-1972-57-3277
Chen, et al.	CHPLBC-1968-2-593
Moore and Zittel	SCIEAS-1973-182-541 (rev.)

b. $HCl^{\ddagger}(v_i = m) + M \rightarrow HCl^{(\ddagger)}(v_j < m) + M^{\ddagger}\ (v_j \geq 0)$

(energy transferred from $HCl^{\ddagger}$ to M)

Ahl and Cool	JCPSA6-1973-58-5540
Airey, J. R.	IEJQA7-1970-6-175
Airey, J. R.	JCPSA6-1970-52-156
Bott and Cohen	JCPSA6-1973-58-4539
Bowen and Overholser	ASACAW-1969-14-475
Chen and Moore	IEJQA7-1970-6-175

Chen and Moore	JCPSA6-1971-54-4072
Chen and Moore	JCPSA6-1971-54-4080
Chen, et al.	CHPLBC-1968-2-593
Cool, et al.	IJCKBO-1969-1-495 (r. p.)
Cool, et al.	JAPIAU-1970-41-4038 (r. p.)
Dillon and Stephenson	JCPSA6-1973-58-2056 (calc.,cr. sect.)
Hopkins, et al.	JCPSA6-1973-59-836
Hopkins and Chen	JCPSA6-1972-57-3161
Moore, C. B.	ACHRAY-1969-2-103 (rev.)
Moore and Zittel	SCIEAS-1973-182-541 (rev.)
Sentman, L. H.	CHPLBC-1973-18-493 (calc.,model.)
Stephenson, et al.	JCPSA6-1972-56-5214
Zittel and Moore	JCPSA6-1973-58-2004

c. $HCl(v_i) + HCl(v_j) \rightarrow HCl(v_k) + HCl(v_\ell)$ $(i + j = k + \ell)$
(HCl - HCl energy transfer)

Bowen and Overholser	ASACAW-1969-14-475
Chen and Moore	JCPSA6-1971-54-4072
Chen and Moore	JCPSA6-1971-54-4080
Chen, et al.	CHPLBC-1968-2-593
Cohen, et al.	IJCKBO-1969-1-551
Corneil and Kasper	IEJQA7-1970-6-170 (calc.)
Findlay and Polanyi	CJCHAG-1964-42-2176
Findlay and Polanyi	DFSOAW-1962-33-274
Gorshkov, et al.	APOPAI-1971-10-1781
Hopkins and Chen	IEJQA7-1973-9-196
Hopkins and Chen	JCPSA6-1972-57-3816
Igoshin and Oraevskii	HIECAP-1971-5-357 (calc.)
Leone and Moore	CHPLBC-1973-19-340
Moore and Zittel	SCIEAS-1973-182-541 (rev.)
Polanyi, J. C.	JQSRAE-1963-3-471 (rev.)
Sentman, L. H.	CHPLBC-1973-18-493 (calc.,model.)
Sharma, et al.	JCPSA6-1973-58-3519 (calc.)

2. $HCl^{\ddagger}(DCl^{\ddagger})$ Quenching

a. $HCl^{\ddagger}(v_i = m) + M \rightarrow HCl^{(\ddagger)}(v_j < m) + M$ $(v_j \geq 0)$ (collisional quenching)

Ahl and Cool	JCPSA6-1973-58-5540
Bott and Cohen	JCPSA6-1973-58-4539
Bowen and Overholser	ASACAW-1969-14-475
Chen and Moore	JCPSA6-1971-54-4072
Chen, et al.	CHPLBC-1968-2-593
Cohen, et al.	IJCKBO-1969-1-551
Corneil and Kasper	IEJQA7-1970-6-170 (calc.)
Craig and Moore	JPCHAX-1971-75-1622
Gorshkov, et al.	APOPAI-1971-10-1781
Hopkins and Chen	JCPSA6-1972-57-3161
Kapralova, et al.	CHPLBC-1968-2-581 (calc.,trans. prob.)
Letokhov, V. S.	SCIEAS-1973-180-451

Moore and Zittel	SCIEAS-1973-182-541 (rev.)
Ridley and Smith	CHPLBC-1971-9-457
Ridley and Smith	JCFTBS-1972-68-1231
Seery, D. J.	JCPSA6-1973-58-1796
Sentman, L. H.	CHPLBC-1973-18-493 (calc.,model.)
Smith and Wood	MOPHAM-1973-25-441
Zittel and Moore	JCPSA6-1973-58-2004

b. $HCl^{\ddagger}(v_i = m) + HCl \rightarrow HCl^{(\ddagger)}(v_j < m) + HCl\ (v_j \geq 0)$

(HCl - HCl self-quenching)

Ahl and Cool	JCPSA6-1973-58-5540
Borrell, P.	CSSPAD-1966-20-263
Bowen and Overholser	ASACAW-1969-14-475
Bowman and Seery	JCPSA6-1969-50-1904
Breazeale and Kneser	JASMAN-1960-32-885
Breshears and Bird	JCPSA6-1969-50-333
Cabre and Henry	JCPQAY-1967-64-119 (pop. distr.)
Chen, H-L.	JCPSA6-1971-55-5551
Chen and Moore	JCPSA6-1971-54-4072
Chen, et al.	CHPLBC-1968-2-593
Cohen, et al.	IJCKBO-1969-1-551
Corneil, P. H.	DABSA9-1968-28-4524 (r. p.)
Corneil and Kasper	IEJQA7-1970-6-170
Ferguson and Read	TFSOA4-1967-63-61 (calc.)
Kapralova, et al.	CHPLBC-1968-2-581 (calc.,trans. prob.)
Letokhov, V. S.	SCIEAS-1973-180-451
Margottin-Maclou, et al.	APOPAI-1971-10-1768
Molina and Pimentel	IEJQA7-1973-9-64
Moore, C. B.	JCPSA6-1965-43-297 (calc.,model.)
Ridley and Smith	JCFTBS-1972-68-1231
Sentman, L. H.	CHPLBC-1973-18-493 (calc.,model.)
Shin, H. K.	CHPLBC-1970-6-494 (calc.)
Shin, H. K.	JPCHAX-1971-75-1079 (calc.)
Stephenson, et al.	JCPSA6-1972-56-5214
Thommarson and Berend	IJCKBO-1973-5-629 (calc.,pot. surf., traj.)
Thompson, D. L.	JCPSA6-1972-56-3570 (calc.,pot. surf., traj.)
Thompson, D. L.	JCPSA6-1972-57-2589
Zittel and Moore	JCPSA6-1973-58-2004

c. $HCl^{\ddagger}(v_i = m) + M_2 \rightarrow HCl(v_j = 0) + M + M$ (dissociative quenching)

Anlauf, et al.	JCPSA6-1969-51-5716
Slootmaekers and Van Tiggelen	BSCBAG-1958-67-135 (r. p.)

C. $HCl^{\ddagger}$ ($DCl^{\ddagger}$) Theoretical papers

Anlauf, et al.	JCPSA6-1970-53-4091 (calc.,pop. distr.)
Anlauf, et al.	JCPSA6-1972-57-1561 (calc., d. r.)
Anlauf, et al.	JCPSA6-1968-49-5189 (pop. distr.)
Ben-Shaul, et al.	CHPLBC-1972-15-160 (pop. distr.)
Ben-Shaul, et al.	JCPSA6-1972-57-5427 (calc.,pop. distr.)
Dillon and Stephenson	JCPSA6-1973-58-2056 (calc.,cr. sect.)
Kapralova, et al.	CHPLBC-1968-2-581 (calc.,trans. prob.)
Levine, et al.	CHPLBC-1973-19-1 (pop. distr.)
Miller and Light	JCPSA6-1971-54-1643 (calc.,pot. surf.)
Moore, C. B.	JCPSA6-1965-43-2979 (calc.,model.)
Parr and Truhlar	JPCHAX-1971-75-1844 (calc.,pot. surf.)
Parr, et al.	JCPSA6-1973-58-5 (calc.,pop. distr., pot. surf.,traj.)
Polanyi, J. C.	APOSAR-1965-2-109 (pot. surf.)
Polanyi, J. C.	JCPSA6-1959-31-1338 (pop. distr.)
Polanyi and Rosner	JCPSA6-1963-38-1028 (r. p.)
Polanyi and Woodall	JCPSA6-1972-56-1563 (calc.,pop. distr.)
Raff, et al.	JCPSA6-1970-53-1606 (calc.)
Rankin and Light	JCPSA6-1969-51-1701 (calc.,pop. distr., pot. surf.)
Russell and Light	JCPSA6-1969-51-1270 (calc.,pop. distr., traj.)
Sentman, L. H.	CHPLBC-1973-18-493 (calc.,model.)
Sharma, et al.	JCPSA6-1973-58-3519 (calc.)
Shin, H. K.	CHPLBC-1970-6-494 (calc.,model.)
Shin, H. K.	JPCHAX-1971-75-1079 (calc.)
Stern, et al.	JCPSA6-1973-58-5697 (calc.,model.)
Wei and Yankwich	JCPSA6-1973-58-5552 (calc.)

Part III. Hydrogen bromide (HBr, DBr)

A. Formation of $HBr^{\ddagger}(DBr^{\ddagger})$

1. Bimolecular reactions (abstraction lasers)

a. Abstraction of H (D) atom by Br atom

i. $Br + H_2 \rightarrow HBr^{\ddagger} + H$

Bodenstein and Jung	ZEPCAC-1926-121-127 (r. p.)
Deutsch, T. F.	APPLAB-1967-10-234 (r. p.)
Deutsch, T. F.	IEJQA7-1967-3-419 (r. p.)
Fettis and Knox	PRKNAZ-1964-2-2 (r. p.)
Jost, W.	ZPCBAL-1929-3-95 (r. p.)
Raff, et al.	JCPSA6-1970-53-1606 (calc.)
Truhlar, D. G.	JCPSA6-1972-56-3189 (pot. surf.)
Wood and Chang	APPLAB-1972-20-77 (r. p.)

ii. $Br + HX \rightarrow HBr^{\ddagger} + X$

Anlauf, et al.	DFSOAW-1967-44-183 (calc.)
Blauer, et al.	XADRCA-1972-AD 738296
Maylotte, et al.	JCPSA6-1972-57-1547 (pop. distr.)

iii. $Br + RH \rightarrow HBr^{\ddagger} + R$

Fettis and Knox	PRKNAZ-1964-2-2 (r. p.)

b. Abstraction of Br Atom by H(D) Atom

i. $H + Br_2 \rightarrow HBr^{\ddagger} + Br$

Airey, et al.	SYMCAQ-1967-11-85
Anlauf, K. G.	DABPBA-1970-31-1195
Anlauf, et al.	JCPSA6-1970-53-4091 (calc.,pop. distr.)
Anlauf, et al.	JCPSA6-1972-57-1561 (calc., d. r.)
Anlauf, et al.	DFSOAW-1967-44-183 (calc.,pop. distr.)
Anlauf, et al.	PYLAAG-1967-24-208 (pop. distr.)
Ben-Shaul, et al.	JCPSA6-1972-57-5427 (calc.,pop. distr.)
Bodenstein and Jung	ZEPCAC-1926-121-127 (r. p.)
Cashion and Polanyi	PRLAAZ-1960-258-570
Chester, A. N.	JCPSA6-1970-53-3595 (calc.,pop. distr.)
Cool and Stephens	JCPSA6-1970-52-3304 (r. p.)
Fass, et al.	JPCHAX-1972-76-2801
Jost, W.	ZPCBAL-1929-3-95 (r. p.)
Mayer, et al.	SYMCAQ-1967-11-837 (r. p.)
Pimentel, G. C.	PACHAS-1969-18-275 (rev.)
Polanyi, J. C.	IEJQA7-1970-6-168 (r. p.)
Polanyi, J. C.	JCPSA6-1959-31-1338 (rev.)
Wagner and Wolfrum	ACIEAY-1971-10-604 (rev.)
White, J. M.	JCPSA6-1973-58-4482 (calc., cr. sec., pop. distr.,traj.)

ii. $H + BrX \rightarrow HBr^{\ddagger} + X$

Ben-Shaul, et al.	JCPSA6-1972-57-5427 (calc.,pop. distr.)
Mayer, et al.	SYMCAQ-1967-11-837 (r. p.)

B. $HBr^{\ddagger}$ ($DBr^{\ddagger}$) Energy Transfer and Quenching

1. $HBr^{\ddagger}$ ($DBr^{\ddagger}$) Energy Transfer

a. $HBr(v_i = 0) + M^{\ddagger} \rightarrow HBr^{\ddagger}(v_j > 0) + M \ (M \neq HBr)$
(energy transferred to HBr from $M^{\ddagger}$)

Ahl and Cool	JCPSA6-1973-58-5540
Airey, J. R.	IEJQA7-1970-6-175
Airey, J. R.	JCPSA6-1970-52-156
Bott and Cohen	JCPSA6-1973-58-4539
Chen and Moore	IEJQA7-1970-6-175
Chen and Moore	JCPSA6-1971-54-4080
Cool, et al.	JAPIAU-1970-41-4038
Donovan, et al.	TFSOA4-1970-66-2148
Moore and Zittel	SCIEAS-1973-182-541 (rev.)

b. $HBr^{\ddagger}(v_i = m) + M \rightarrow HBr^{(\ddagger)}(v_j < m) + M^{\ddagger} \ (v_j \geq 0)$
(energy transferred from $HBr^{\ddagger}$ to M)

Ahl and Cool	JCPSA6-1973-58-5540
Bott and Cohen	JCPSA6-1973-58-4539
Chen, H-L.	JCPSA6-1971-55-5551
Chen, H-L.	JCPSA6-1971-55-5557
Cool and Stephens	JCPSA6-1970-52-3304 (r. p.)
Donovan, et al.	TFSOA4-1970-66-2148
Hopkins, et al.	JCPSA6-1973-59-836
Hopkins and Chen	JCPSA6-1973-59-1495
Sentman, L. H.	CHPLBC-1973-18-493 (calc.,model.)
Stephenson, et al.	JCPSA6-1972-56-5214

c. $HBr(v_i) + HBr(v_j) \rightarrow HBr(v_k) + HBr(v_\ell) \ (i + j = k + \ell)$
(HBr - HBr energy transfer)

Chen, H-L.	JCPSA6-1971-55-5551

2. $HBr^{\ddagger}$ ($DBr^{\ddagger}$) Quenching

a. $HBr^{\ddagger}(v_i = m) + M \rightarrow HBr^{(\ddagger)}(v_j < m) + M \ (v_j \geq 0)$
(collisional quenching)

Ahl and Cool	JCPSA6-1973-58-5540
Bott and Cohen	JCPSA6-1973-58-4539
Chen and Chen	JCPSA6-1972-56-3315
Hopkins and Chen	JCPSA6-1973-59-1495
Sentman, L. H.	CHPLBC-1973-18-493 (calc.,model.)

b. $HBr^{\ddagger}(v_i = m) + HBr \rightarrow HBr^{(\ddagger)}(v_j < m) + HBr\ (v_j \geq 0)$
(HBr - HBr self-quenching)

Ahl and Cool	JCPSA6-1973-58-5540
Borrell, P.	CSSPAD-1966-20-263
Breshears and Bird	JCPSA6-1970-52-999
Chen and Chen	JCPSA6-1972-56-3315
Ferguson and Read	TFSOA4-1967-63-61
Kapralova, et al.	CHPLBC-1968-2-581 (calc.,trans. prob.)
Kiefer, et al.	JCPSA6-1969-50-3641
Moore, C. B.	JCPSA6-1965-43-2979 (calc.,model.)
Sharma, et al.	JCPSA6-1973-58-3519 (calc.)
Shin, H. K.	JPCHAX-1971-75-1079 (calc.)
Shin, H. K.	JCPSA6-1968-49-3964 (r. p.)
Stephenson, et al.	JCPSA6-1972-56-5214

C. $HBr^{\ddagger}$ ($DBr^{\ddagger}$) Theoretical papers

Anlauf, et al.	JCPSA6-1972-57-1561 (d. r.)
Ben-Shaul, et al.	JCPSA6-1972-57-5427 (calc.,pop. distr.)
Chester, A. N.	JCPSA6-1970-53-3595 (calc.)
Kapralova, et al.	CHPLBC-1968-2-581 (calc.,trans. prob.)
Moore, C. B.	JCPSA6-1965-43-2979 (calc., model.)
Parr and Truhlar	JPCHAX-1971-75-1844 (calc.,pot. surf.)
Pirkle and McGee	JCPSA6-1968-49-3532 (calc.,cr. sect., pot. surf.)
Polanyi, J. C.	JCPSA6-1959-31-1338 (rev.)
Raff, et al.	JCPSA6-1970-53-1606 (calc.)
Sentman, L. H.	CHPLBC-1973-18-493 (calc.,model.)
Sharma, et al.	JCPSA6-1973-58-3519 (calc.)
Shin, H. K.	JPCHAX-1971-75-1079 (calc.)
Shin, H. K.	JCPSA6-1968-49-3964 (r. p.)
White, J. M.	JCPSA6-1973-58-4482 (calc., cr. sec., pop. distr.,traj.)

Part IV. Hydrogen iodide (HI, DI)

A. Formation of $HI^{\ddagger}(DI^{\ddagger})$

1. Bimolecular Reactions (abstraction lasers)

a. Abstraction of H(D) Atom by I Atom

i. $I + H_2 \rightarrow HI^{\ddagger} + H$

Fettis and Knox	PRKNAZ-1964-2-2 (r. p.)
Henry, et al.	CHPLBC-1973-20-138 (r.p.,traj.)
Parr and Truhlar	JPCHAX-1971-75-1844 (calc.,pot. surf.)
Raff, et al.	JCPSA6-1970-53-1606 (calc.)
Truhlar, D. G.	JCPSA6-1972-56-3189 (pot. surf.)

ii. $I + HX \rightarrow HI^{\ddagger} + X$

Anlauf, et al.	JCPSA6-1969-51-5716

iii. $I + RH \rightarrow HI^{\ddagger} + R$

Wagner and Wolfrum	ACIEAY-1971-10-604 (rev.)

b. Abstraction of I Atom by H(D) Atom

i. $H + I_2 \rightarrow HI^{\ddagger} + I$

Anderson and Kung	JCPSA6-1973-58-2477 (pop. distr.,traj.)
Ben-Shaul, et al.	JCPSA6-1972-57-5427
Mayer, et al.	SYMCAQ-1967-11-837 (r. p.)
Penzhorn and Darwent	JPCHAX-1968-72-1639 (r. p.)
Sullivan, J. H.	JCPSA6-1963-39-3001 (r. p.)

ii. $H + IX \rightarrow HI^{\ddagger} + X$

Ben-Shaul, et al.	JCPSA6-1972-57-5427 (calc.,pop. distr.)
Johnson, et al.	JPCHAX-1973-77-2499 (calc.,pot. surf., traj.)
Mayer, et al.	SYMCAQ-1967-11-837 (r. p.)

B. $HI^{\ddagger}(DI^{\ddagger})$ Energy Transfer and Quenching

1. $HI^{\ddagger}(DI^{\ddagger})$ Energy Transfer

a. $HI(v_i = 0) + M^{\ddagger} \rightarrow HI^{\ddagger}(v_j > 0) + M$ ($M \neq HI$)

(energy transferred to HI from $M^{\ddagger}$)

Ahl and Cool	JCPSA6-1973-58-5540
Chen, H-L.	JCPSA6-1971-55-5551
Chen and Moore	JCPSA6-1971-54-4080
Chen, et al.	CHPLBC-1968-2-593

b. $HI^{\ddagger}(v_i = m) + M \rightarrow HI^{(\ddagger)}(v_j < m) + M^{\ddagger}\ (v_j \geq 0)$
(energy transferred from $HI^{\ddagger}$ to M)

Ahl and Cool	JCPSA6-1973-58-5540
Breshears and Bird	JCPSA6-1971-54-2968
Chen, H-L.	JCPSA6-1971-55-5551
Stephenson, et al.	JCPSA6-1972-56-5214

c. $HI(v_i) + HI(v_j) \rightarrow HI(v_k) + HI(v_\ell)(i + j = k + \ell)$
(HI - HI energy transfer)

Chow and Greene	JCPSA6-1965-43-324
Sentman, L. H.	CHPLBC-1973-18-493 (calc.,model.)

2. $HI^{\ddagger}(DI^{\ddagger})$ Quenching

a. $HI^{\ddagger}(v_i = m) + M \rightarrow HI^{(\ddagger)}(v_j < m) + M\ (v_j \geq 0)$
(collisional quenching)

Ahl and Cool	JCPSA6-1973-58-5540
Breshears and Bird	JCPSA6-1971-54-2968
Chen, H-L.	JCPSA6-1971-55-5551
Chow and Greene	JCPSA6-1965-43-324
Kapralova, et al.	CHPLBC-1968-2-581 (calc.,trans. prob.)
Kiefer, et al.	JCPSA6-1969-50-3641

b. $HI^{\ddagger}(v_i = m) + HI \rightarrow HI^{(\ddagger)}(v_j < m) + HI\ (v_j \geq 0)$
(HI - HI self-quenching)

Ahl and Cool	JCPSA6-1973-58-5540
Breshears and Bird	JCPSA6-1971-54-2968
Chen, H-L.	JCPSA6-1971-55-5551
Chow and Greene	JCPSA6-1965-43-324
Kapralova, et al.	CHPLBC-1968-2-581 (calc.,trans. prob.)
Moore, C. B.	JCPSA6-1965-43-2979
Sentman, L. H.	CHPLBC-1973-18-493 (calc.,model.)
Shin, H. K.	JPCHAX-1971-75-1079

C. $HI^{\ddagger}(DI^{\ddagger})$ Theoretical papers

Anderson and Kung	JCPSA6-1973-58-2477 (pop. distr.,traj.)
Ben-Shaul, et al.	JCPSA6-1972-57-5427 (calc.,pop. distr.)
Henry, et al.	CHPLBC-1973-20-138 (r.p.,traj.)
Kapralova, et al.	CHPLBC-1968-2-581 (calc.,trans. prob.)
Moore, C. B.	JCPSA6-1965-43-2979
Sentman, L. H.	CHPLBC-1973-18-493 (calc.,model.)
Shin, H. K.	JPCHAX-1971-75-1079

Arnold and Rojeska	APOPAI-1973-12-169
Borrell, P.	BOOKA7-1969-2-180
Carrington and Garvin	CCHKAZ-1969-3-174
Carrington and Polanyi	26BMAD-1972-9-135
Chester, A. N.	LSRVAN-1971-7-25
Chester and Hess	IEJQA7-1972-8-1
Cohen, N.	XADRCA-1972-AD 763715
Cool, T. A.	BOOKA7-1971-197
Cool, T. A.	IEJQA7-1973-9-72
Dobratz, B. M.	XERLAR-1972-UCRL 51285
Dzhidzhoev, M. S.	SPUSBI-1970-13-237
Emanuel, et al.	XADRCA-1972-AD 746685
Fettis and Knox	PRKNAZ-1964-2-2
Kerber, et al.	IEJQA7-1973-9-94
Kompa, K. L.	ACIEAY-1970-9-773
Kompa, K. L.	CITEAH-1970-42-573
Moore, C. B.	ADCPAA-1973-23-41
Moore, C. B.	ARPLAP-1971-22-387
Moore, C. B.	ACHRAY-1969-2-103
Moore, C. B.	BOOKA7-1967-133
Pimentel, G. C.	DAKEAT-1969-50-1
Pimentel, G. C.	PACHAS-1969-18-275
Rabinovitch and Flowers	QRCSAL-1964-18-122
Shuler, et al.	APOSAR-1965-2-81
Wagner and Wolfrum	ACIEAY-1971-10-604

PART VI. REFERENCES

Ahl, J. L., and Cool, T. A., "Vibrational Relaxation in the HF-HCl, HF-HBr, HF-HI, and HF-DF Systems," J. Chem. Phys. 58, 5540 (1973)

Airey, J. R., "A New Pulsed I-R Chemical Laser," IEEE J. Quant. Electr. QE-3, 208 (1967)

Airey, J. R., "Report on the International Symposium on Chemical Lasers, Moscow, September 2-4, 1969," Int. J. Chem. Kinet. 2, 65 (1970)

Airey, J. R., "Cl + HBr Pulsed Chemical Laser: A Theoretical and Experimental Study," J. Chem. Phys. 52, 156 (1970); also, see Airey, J. R., "Cl + HBr Pulsed Chemical Laser: A Theoretical and Experimental Study," IEEE J. Quant. Electr. QE-6, 175 (1970)

Airey, J. R., Findlay, F. D., and Polanyi, J. C., "The Hydrogen-Chlorine System in the MM Pressure Range. II. The Vibrational Ground State Studied by Self-Absorption," Can. J. Chem. 42, 2193 (1964)

Airey, J. R., and Fried, S. F., "Vibrational Relaxation of Hydrogen Fluoride," Chem. Phys. Ltrs. 8, 23 (1971)

Airey, J. R., Getty, R. R., Polanyi, J. C., and Snelling, D. R., "Absolute Efficiency of Conversion of Heat of the Reaction H + Cl_2 into Vibration," J. Chem. Phys. 41, 3255 (1964)

Airey, J. R., and McKay, S. F., "A Supersonic Mixing Chemical Laser," Appl. Phys. Ltrs. 15, 401 (1969)

Airey, J. R., Pacey, P. D., and Polanyi, J. C., "Infrared Chemiluminescence in the Systems H + Br_2 and H + Br," Symp. Combust. 11 (Combustion Institute, Pittsburgh, 1967) 85

Airey, J. R., and Smith, I. W. M., "Quenching of Infrared Chemiluminescence: Rates of Energy Transfer from HF($v \leq 5$) to CO_2 and HF, and from DF($v \leq 3$) to CO_2 and HF," J. Chem. Phys. 57, 1669 (1972)

Albright, R. G., Dodonov, A. F., Lavrovskaya, G. K., Morosov, I. I., and Tal'roze, V. L., "Mass-Spectrometric Determination of Rate Constants for H-Atom Reactions with Cl_2 and F_2," J. Chem. Phys. 50, 3632 (1969)

Anderson, J. B., and Kung, R. T. V., "Vibrational Population Inversion in Hydrogen Iodide From $H + I_2 \rightarrow HI + I$," J. Chem. Phys. 58, 2477 (1973)

Anlauf, K. G., "Energy Distributions among Reaction Products from the Systems $H + Cl_2$, $H + Br_2$, and H + ClNO," Diss. Abstr. Int. B 31, 1195 (1970)

Anlauf, K. G., Charters, P. E., Horne, D. S., MacDonald, R. G., Maylotte, D. H., Polanyi, J. C., Skrlac, W. J., Tardy, D. C., and Woodall, K. B., "Translational Energy-Distribution in the Products of Some Exothermic Reactions," J. Chem. Phys. 53, 4091 (1970)

Anlauf, K. G., Dawson, P. H., and Herman, J. A., "Relaxation of Vibrationally Excited HF in Levels v=1 and v=2. II. By CH_4, C_2H_6, C_3H_8, C_2H_2, and C_2H_4," J. Chem. Phys. 58, 5354 (1973)

Anlauf, K. G., Horne, D. S., MacDonald, R. G., Polanyi, J. C., and Woodall, K. B., "Energy Distribution among Reaction Products. V. $H + X_2 (X \equiv Cl, Br)$, $D + Cl_2$," J. Chem. Phys. 57, 1561 (1972)

Anlauf, K. G., Kuntz, P. J., Maylotte, D. H., Pacey, P. D., and Polanyi, J. C., "Energy Distribution among Reaction Products. Part 2. $H + X_2$ and X + HY," Discussions Faraday Soc. 44, 183 (1967)

Anlauf, K. G., Maylotte, D. H., Pacey, P. D., and Polanyi, J. C., "Vibrational Population-Inversion and Stimulated Emission from the Continuous-Mixing of Chemical Reagents," Phys. Ltrs. A 24, 208 (1967)

Anlauf, K. G., Maylotte, D. H., Polanyi, J. C., and Bernstein, R. B., "Rates of the Endothermic Reactions HCl + X(X ≡ I, Cl) as a Function of Reagent Vibration, Rotation, and Translation," J. Chem. Phys. 51, 5716 (1969)

Anlauf, K. G., Polanyi, J. C., Wong, W. H., and Woodall, K. B., "Distribution of Reaction Products. III. Cl + HI, Cl + DI," J. Chem. Phys. 49, 5189 (1968)

Arnold, S. J., and Rojeska, H., "Chemical Lasers: A Comprehensive Literature Survey," Appl. Opt. 12, 169 (1973)

Ashmore, P. G., "The Theory of Non-Branching Chain Reactions with Alternating Centres," Tran. Faraday Soc. 49, 251 (1953)

Ashmore, P. G., and Chanmugam, J., "Reactions in the System Hydrogen, Chlorine, Nitric Oxide and Nitrosyl Chloride. Part 1. The Reaction between Hydrogen and Chlorine in the Presence of Nitric Oxide and Nitrosyl Chloride," Trans. Faraday Soc. 49, 254 (1953)

Basov, N. G., Galochkin, V. T., Igoshin, V. I., Kulakov, L. V., Martin, E. P., Nikitin, A. I., and Oraevsky, A. N., "Spectra of Stimulated Emission in the Hydrogen-Fluorine Reaction Process and Energy Transfer from DF to CO_2," Appl. Opt. 10, 1814 (1971)

Basov, N. G., Gromov, V. V., Koshelev, E. L., Markin, E. P., and Oraevskii, A. N., "Generation Spectrum of a Chemical Laser using a Mixture of H_2 and Cl_2," JETP Ltrs. 9, 147 (1969); tr. of Zh. Eksp. Teor. Fiz Pis'ma Red. 9, 250 (1969)

Basov, N. G., Kulakov, L. V., Markin, E. P., Nikitin, A. I., and Oraevskii, A. N., "Emission Spectrum of a Chemical Laser using an $H_2 + F_2$ Mixture," JETP Ltrs. 9, 375 (1969); tr. of Zh. Eksp. Teor. Fiz. Pis'ma Red. 9, 613 (1969)

Basov, N. G., Markin, E. P., Nikitin, A. I., and Oraevsky, A. N., "Branching Reactions and Chemical Lasers," IEEE J. Quant. Electr. QE-6, 183 (1970)

Beattie, W. H., Arnold, G. P., and Wenzel, R. G., "Chemical Efficiency in a Pulsed HF Laser," IEEE J. Quant. Electr. QE-9, 202 (1973)

Ben-Shaul, A., and Levine, R. D., "Entropy and Chemical Change. II. Analysis of Product Energy Distributions: Temperature and Entropy Deficiency," J. Chem. Phys. 57, 5427 (1972)

Ben-Shaul, A., Levine, R. D., and Bernstein, R. B., "Product State Distribution in Exoergic Chemical Reactions and the Concept of Temperature," Chem. Phys. Ltrs. 15, 160 (1972)

Benson, S. W., Cruickshank, F. R., and Shaw, R., "Iodine Monochloride as a Thermal Source of Chlorine Atoms: The Reaction of Chlorine Atoms with Hydrogen," Int. J. Chem. Kinet. 1, 29 (1969)

Berend, G. C., and Thommarson, R. L., "Vibrational Relaxation of HF and DF," J. Chem. Phys. 58, 3203 (1973); also, see Berend, G. C., and Thommarson, R. L., "Vibrational Relaxation of HF and DF," IEEE J. Quant. Electr. QE-9, 195 (1973)

Berend, G. C., and Thommarson, R. L., "Vibrational Relaxation of HF in Ar," J. Chem. Phys. 58, 3454 (1973)

Berend, G. C., and Thommarson, R. L., "Energy Transfer Processes in Molecular Collisions," McDonnell Douglas Astronautics Co. West, AFOSR-TR-73-1210 (July 1973) (National Techn. Information Service, AD763817)

Berry, M. J., "Complete HF Vibrational State Populations Produced by the F + H_2 Reaction," Am. Chem. Soc., 166th Nat'l. Meeting, Abstr. Paper, 166, PHYS-98 (1973)

Berry, M. J., "Vibrational Energy Distributions among the Products of some Unimolecular, Bimolecular, and Photochemical Reactions Studied via Chemical Lasers," Diss. Abstr. Int. B 31, 7210 (1971)

Berry, M. J., "Energy Partitioning in Fluorine-Atom Bimolecular Reactions with Saturated and Unsaturated Hydrocarbons," IEEE J. Quant. Electr. QE-9, 199 (1973)

Berry, M. J., and Pimentel, G. C., "Hydrogen Halide Elimination and Photoelimination Chemical Lasers and the Dynamics of Unimolecular Reaction," IEEE J. Quant. Electr. QE-6, 176 (1970)

Berry, M. J., and Pimentel, G. C., "Hydrogen Fluoride Elimination Chemical Laser," J. Chem. Phys. 49, 5190 (1968)

Berry, M. J., and Pimentel, G. C., "Hydrogen Halide Photoelimination Chemical Lasers," J. Chem. Phys. 51, 2274 (1969)

Berry, M. J., and Pimentel, G. C., "Vibrational Energy Distribution in the Dichloroethylene Photoelimination Chemical Lasers," J. Chem. Phys. 53, 3453 (1970)

Blair, L. S., Breshears, W. D., and Schott, G. L., "Vibrational Relaxation of HF in the Temperature Range 600-2400°K," J. Chem. Phys. 59, 1582 (1973)

Blais, N. C., and Truhlar, D. G., "Monte Carlo Trajectories: Dynamics of the Reaction F + D_2 on a Semiempirical Valence-Bond Potential Energy Surface," J. Chem. Phys. 58, 1090 (1973)

Blauer, J., Engleman, V. S., and Solomon, W. C., "Interactions of Halogen Atoms with Shock-Heated Hydrogen Fluoride," Symp. Combust. 13 (Combustion Institute, Pittsburgh, 1971) 109

Blauer, J. A., and Solomon, W. C., "Catalytic Efficiencies of Atoms in the Vibrational Relaxation of HF and DF," Symp. Combust. 14 (Combustion Institute, Pittsburgh, 1973) 189

Blauer, J. A., and Solomon, W. C., "Deactivation of Vibrationally Excited Hydrogen Fluoride (v=2 and v=1) by Atomic Fluorine," Int. J. Chem. Kinet. 5, 553 (1973)

Blauer, J. A., Solomon, W. C., and Owens, T. W., "Vibrational Excitation of Deuterium Fluoride and Hydrogen Fluoride by Atomic and Diatomic Species," Int. J. Chem. Kinet. 4, 293 (1972)

Blauer, J. A., Solomon, W. C., and Owens, T. W., "Collisional Efficiency in Vibrational Excitation of HF and DF," Air Force Rocket Propulsion Lab., Edwards, Calif., AFRPL-TR-72-15 (April 1972), (National Techn. Information Service, AD738296)

Blauer, J. A., Solomon, W. C., Sentman, L. H., and Owens, T. W., "Catalytic Efficiencies of H_2O, D_2O, NO, and HCl in the Vibrational Relaxation of HF and DF," J. Chem. Phys. 57, 3277 (1972)

Bodenstein, M., and Jung, G., "Die Dissoziation der Wasserstoffmolekel," Z. physik. Chem. 121, 127 (1926)

Borrell, P., "The Measurement of Vibrational Relaxation Rates by Shock Techniques," in "Transfer and Storage of Energy by Molecules," Vol. 2, G. M. Burnett and A. M. North, editors, (Wiley - Interscience, New York 1969) 180

Borrell, P., "Measurements of Vibrational Relaxation in Hydrogen Chloride and Bromide by Observation of the Infrared Emission from the Shock-Heated Gases," Chem. Soc. Special Publication 20, 263 (1966)

Bott, J., "Vibrational Relaxation Measurements by Hydrogen Fluoride," IEEE J. Quant. Electr. QE-9, 189 (1973)

Bott, J. F., "HF Vibrational Relaxation Measurements Using the Combined Shock Tube-Laser-Induced Fluorescence Technique," J. Chem. Phys. 57, 96 (1972)

Bott, J. F., and Cohen, N., "Shock-Tube Studies of HF Vibrational Relaxation," J. Chem. Phys. 55, 3698 (1971)

Bott, J. F., and Cohen, N., "HF Vibrational Relaxation by F Atoms," J. Chem. Phys. 55, 5124 (1971)

Bott, J. F., and Cohen, N., "Shock Tube Study of DF Vibrational Relaxation," J. Chem. Phys. 58, 934 (1973)

Bott, J. F., and Cohen, N., "Temperature Dependence of V-V and V-R,T Energy Transfer Measurements in Mixtures Containing HF," J. Chem. Phys. 58, 4539 (1973)

Bott, J. F., and Cohen, N., "Temperature Dependence of Several Vibrational Relaxation Processes in DF-CO_2 Mixtures," J. Chem. Phys. 59, 447 (1973)

Bowen, J. R., and Overholser, K. A., "An Appraisal of the Continuous Explosion Laser," Astronautica Acta 14, 475 (1969)

Bowman, C. T., and Seery, D. J., "Vibrational Relaxation of HCl behind Shock Waves," J. Chem. Phys. 50, 1904 (1969)

Breazealet, M. A., and Kneser, H. O., "Rotational Relaxation in Hydrogen Chloride," J. Acoust. Soc. Am. 32, 885 (1960)

Breshears, W. D., and Bird, P. F., "Densitometric Measurement of the Vibrational Relaxation of HCl and DCl in Shock Waves," J. Chem. Phys. 50, 333 (1969)

Breshears, W. D., and Bird, P. F., "Vibrational Relaxation of Hydrogen Halides: DBr and DI," J. Chem. Phys. 52, 999 (1970)

Breshears, W. D., and Bird, P. F., "Vibrational Energy Transfer in Shock-Heated N_2-HI and N_2-DI Mixtures," J. Chem. Phys. 54, 2968 (1971)

Brokaw, R. S., "A Suggested Mechanism for the Hydrogen-Fluorine Reaction," J. Phys. Chem. 69, 2488 (1965)

Brokaw, R. S., "A Suggested Mechanism for the Hydrogen-Fluorine Reaction. II. The Oxygen-Inhibited Reaction," J. Phys. Chem. 69, 2808 (1965)

Brus, L. E., and Lin, M. C., "Chemical HF Lasers from Flash Photolysis of Various N_2F_4 + RH Systems," J. Phys. Chem. 75, 2546 (1971)

Burmasov, V. S., Dolgov-Savel'ev, G. G., Polyakov, V. A., and Chumak, G. M., "Quantum Yield of Generation of an H_2 + F_2 Mixture," JETP Ltrs. 10, 28 (1969); tr. of Zh. Eksp. Teor Fiz. Pis'ma Red. 10, 42 (1969)

Cabre, F., and Henry, L., "Formation des Molécules d'Acide Chlorhydrique sur des Niveaux Vibrationnels Excités; Étude de la Relaxation," J. chim. Phys. 64, 119 (1967)

Cabre, F., and Henry, L., "Chimiluminescence de l'Acide Chlorhydrique Formé par Réaction de l'Hydrogène Atomique sur l'Anhydride Hypochloreux," Compt. Rend. B 269, 46 (1969)

Carrington, T., and Garvin, D., "The Chemical Production of Excited States," Comprehensive Chem. Kinet. 3, 174 (1969)

Carrington, T., and Polanyi, J. C., "Chemiluminescent Reactions," MTP Int. Rev. Sci. Phys. Chem. Ser. One, 9, 135 (1972)

Cashion, J. K., and Polanyi, J. C., "Infrared Chemiluminescence from the Gaseous Reaction Atomic H plus Cl_2," J. Chem. Phys. 29, 455 (1958)

Cashion, J. K., and Polanyi, J. C., "Resolved Infrared Emission Spectrum of the Reaction Atomic H• plus Cl_2," J. Chem. Phys. 30, 1097 (1959)

Cashion, J. K., and Polanyi, J. C., "Infrared Chemiluminescence in the System H + NOCl," J. Chem. Phys. 35, 600 (1961)

Cashion, J. K., and Polanyi, J. C., "Infra-red Chemiluminescence. I. Infra-red Emission from Hydrogen Chloride Formed in the Systems Atomic Hydrogen plus Chlorine, Atomic Hydrogen plus Hydrogen Chloride, Atomic Hydrogen plus Deuterium Chloride, and Atomic Deuterium plus Hydrogen Chloride," Proc. Roy. Soc. (London) A 258, 529 (1960)

Cashion, J. K., and Polanyi, J. C., "Infra-red Chemiluminescence. II. Spectroscopic Data," Proc. Roy. Soc. (London) A 258, 564 (1960)

Cashion, J. K., and Polanyi, J. C., "Infra-red Chemiluminescence. III. Infra-red Emission from Hydrogen Bromide Formed in the Systems Atomic Hydrogen plus Bromine, and Atomic Hydrogen plus Hydrogen Bromide," Proc. Roy. Soc. (London) A 258, 570 (1960)

Chang, H. W., Setser, D. W., and Perona, M. J., "Comparison of Energy Partitioning from Three-Centered Processes. Bimolecular Transfer and Unimolecular Elimination Reactions," J. Phys. Chem. 75, 2070 (1971)

Chang, H. W., Setser, D. W., Perona, M. J., and Johnson, R. L., "Comparison of Energy Partitioning by the Reactions of Fluorine Atoms with Hydrogen Sulphide, Water, Hydrogen Peroxide, and Methane," Chem. Phys. Ltrs. 9, 587 (1971)

Chang, H. W., and Setser, D. W., "Infrared Chemiluminescence and Energy Partitioning From the Reactions of Fluorine Atoms with the Primary Carbon-Hydrogen Bonds of Alkanes, Halogenated Methanes, and Tetramethyl Silane," J. Chem. Phys. 58, 2298 (1973)

Charters, P. E., Khare, B. N., and Polanyi, J. C., "Infra-red Chemiluminescence from the Reactions of Atomic Hydrogen at Low Pressures," Nature 193, 367 (1962)

Charters, P. E., and Polanyi, J. C., "Energy Distribution among Reaction Products. Part 1. The Reaction Atomic Hydrogen plus Molecular Chlorine," Discussions Faraday Soc. 33, 107 (1962)

Chen, H-L., "Vibrational Relaxation of Hydrogen Bromide in Gaseous Hydrogen Halide Mixtures," J. Chem. Phys. 55, 5551 (1971)

Chen, H-L., "Vibration-to-Vibration Energy Transfer in Hydrogen Bromide Mixtures," J. Chem. Phys. 55, 5557 (1971)

Chen, H-L., and Moore, C. B., "Vibrational Relaxation of Hydrogen Chloride," IEEE J. Quant. Electr. QE-6, 175 (1970)

Chen, H-L., and Moore, C. B., "Vibration → Rotation Energy Transfer in Hydrogen Chloride," J. Chem. Phys. 54, 4072 (1971)

Chen, H-L., and Moore, C. B., "Vibration → Vibration Energy Transfer in Hydrogen Chloride Mixtures," J. Chem. Phys. 54, 4080 (1971)

Chen, H-L., Stephenson, J. C., and Moore, C. B., "Laser-Excited Vibrational Fluorescence of HCl and the HCl-CO_2 Laser," Chem. Phys. Ltrs. 2, 593 (1968)

Chen, M. Y.-D., and Chen, H-L., "Vibration-to-Rotation Energy Transfer in HBr and DBr Mixtures," J. Chem. Phys. 56, 3315 (1972)

Chester, A. N., "'Complete' and 'Partial' Vibrational Inversion in Chemically Pumped Molecular Lasers," J. Chem. Phys. 53, 3595 (1970)

Chester, A. N., "Chemical Lasers: A Status Report," Laser Focus 7, No. 11, 25 (1971)

Chester, A. N., and Hess, L. D., "Study of the HF Chemical Laser by Pulse-Delay Measurements," IEEE J. Quant. Electr. QE-8, 1 (1972)

Chow, C. C., and Greene, E. F., "Vibrational Relaxation of HI, 1400°-2300°K," J. Chem. Phys. 43, 324 (1965)

Clough, P. N., Polanyi, J. C., and Taguchi, R. T., "Vibrational Energy Distribution in HF Formed by Elimination from Activated CH_3CF_3 and CH_2CF_2," Can. J. Chem. 48, 2919 (1970)

Clyne, M. A. A., McKenney, D. J., and Walker, R. F., "Reaction Kinetics of Ground State Fluorine, $F(^2P)$, Atoms. I. Measurement of Fluorine Atom Concentrations and the Rates of Reactions F + CHF_3 and F + Cl_2 using Mass Spectrometry," Can. J. Chem. 51, 3596 (1973)

Clyne, M. A. A., and Walker, R. F., "Absolute Rate Constants for Elementary Reactions in the Chlorination of CH_4, CD_4, CH_3Cl, CH_2Cl_2, $CHCl_3$, $CDCl_3$ and $CBrCl_3$," J. Chem. Soc. Faraday Trans. I 69, 1547 (1973)

Cohen, N., "A Review of Rate Coefficients for Reactions in the H_2-F_2 Laser System," The Aerospace Corp., El Segundo, Calif., SAMSO-TR-73-209 (Nov. 1972) (National Techn. Information Service, AD763715)

Cohen, N., Jacobs, T. A., Emanuel, G., and Wilkins, R. L., "Chemical Kinetics of Hydrogen Halide Lasers. I. The H_2-Cl_2 System," Int. J. Chem. Kinet. 1, 551 (1969); Erratum: ibid. 2, 339 (1970)

Cohen, N., Wilkins, R. L., and Jacobs, T. A., "Theoretical Calculations of Detonation Initiated Chemical Lasers," IEEE J. Quant. Electr. QE-6, 168 (1970)

Cool, T. A., "A Summary of Recent Research on Continuous-Wave Chemical Lasers," in "Modern Optical Methods in Gas Dynamic Research," Dosanjh, D. H., editor, (Plenum Press, New York, 1971) 197

Cool, T. A., "MDI-The Transfer Chemical Laser: A Review of Recent Research," IEEE J. Quant. Electr. QE-9, 72 (1973)

Cool, T. A., Falk, T. J., and Stephens, R. R., "DF-CO_2 and HF-CO_2 Continuous-Wave Chemical Lasers," Appl. Phys. Ltrs. 15, 318 (1969)

Cool, T. A., and Stephens, R. R., "HBr-CO_2 Continuous-Wave Chemical Laser," J. Chem. Phys. 52, 3304 (1970)

Cool, T. A., Stephens, R. R., and Falk, T. J., "A Continuous-Wave Chemically Excited CO_2 Laser," Int. J. Chem. Kinet. 1, 495 (1969)

Cool, T. A., Stephens, R. R., and Shirley, J. A., "HCl, HF, and DF Partially Inverted cw Chemical Lasers," J. Appl. Phys. 41, 4038 (1970)

Coombe, R. D., and Pimentel, G. C., "Temperature Dependence of the Vibrational Energy Distributions in the Reactions F + H_2 and F + D_2," J. Chem. Phys. 59, 251 (1973)

Coombe, R. D., and Pimentel, G. C., "Effects of Rotation on the Vibrational Energy Distributions in the Reaction F + H_2," J. Chem. Phys. 59, 1535 (1973)

Coombe, R. D., Pimentel, G. C., and Berry, M. J., "Chemical Laser Study of the Reaction F + HI by the Equal-Gain Technique," IEEE J. Quant. Electr. QE-9, 192 (1973)

Corneil, P. H., "The HCl Chemical Laser," Diss. Abstr. Int. B 28 4524 (1968)

Corneil, P. H., and Kasper, J. V. V., "Computer Simulation of the HCl Explosion Laser," IEEE J. Quant. Electr. QE-6, 170 (1970)

Corneil, P. H., and Pimentel, G. C., "Hydrogen-Chlorine Explosion Laser. II. DCl," J. Chem. Phys. 49, 1379 (1968)

Cowley, L. T., Horne, D. S., and Polanyi, J. C., "Infrared Chemiluminescence Study of the Reaction Cl + HI → HCl + I at Enhanced Collision Energies," Chem. Phys. Ltrs. 12, 144 (1971)

Craig, N. C., and Moore, C. B., "Vibrational Relaxation of Hydrogen Chloride by Chlorine Atoms and Chlorine Molecules," J. Phys. Chem. 75, 1622 (1971)

Creighton, J. R., Pearson, R. K., Cowles, J. O., Hermann, G. L., and Gregg, D. W., "Kinetic Reaction Rates from Transverse Discharge Chemical Laser Systems," IEEE J. Quant. Electr. QE-9, 200 (1973)

Cross, J. B., "Molecular Beam Kinetics: D + ClF_3," J. Chem. Phys. 59, 966 (1973)

Cuellar-Ferreira, E., and Pimentel, G. C., "Vibrational Excitation of HF Formed by Elimination from Chemically Activated Ethyl Fluorides," IEEE J. Quant. Electr. QE-9, 201 (1973)

Davis, D. D., Braun, W., and Bass, A. M., "Reactions of $Cl\,^2P_{3/2}$: Absolute Rate Constants for Reaction with H_2, CH_4, C_2H_6, CH_2Cl_2, C_2Cl_4, and c-C_6H_{12}," Int. J. Chem. Kinet. 2, 101 (1970)

Deutsch, T. F., "Molecular Laser Action in Hydrogen and Deuterium Halides," Appl. Phys. Ltrs. 10, 234 (1967)

Deutsch, T. F., "Laser Emission from HF Rotational Transitions," Appl. Phys. Ltrs. 11, 18 (1967)

Deutsch, T. F., "New Infrared Laser Transitions in HCl, HBr, DCl, and DBr," IEEE J. Quant. Electr. QE-3, 419 (1967)

Dillon, T. A., and Stephenson, J. C., "Calculation of Vibrational and Rotational Energy Transfer between HF, DF, HCl, and CO_2," J. Chem. Phys. 58, 2056 (1973)

Dobratz, B. M., "Chemical Lasers: An Overview of the Literature, 1960-1971," U.S. Atomic Energy Commission, UCRL 51285 (Sept. 1972) (National Techn. Information Service)

Dodonov, A. F., Lavrovskaya, G. K., Morozov, I. I., and Tal'roze, V. L., "Mass Spectrometric Determination of the Rate Constant for the Elementary Reaction of Fluorine Atoms with Hydrogen," Dokl. Phys. Chem. 198, 440 (1971); tr. of Dokl. Akad. Nauk SSSR 198, 622 (1971)

Dodonov, A. F., Lavrovskaya, G. K., Morozov, I. I., Ulbright, R. T., Tal'roze, V. L., and Lyubimova, A. K., "Mass-Spectrometric Measurement of the Rate Constant of Elementary Reactions. VI. Reactions of Hydrogen Atoms with Chlorine and Fluorine," Kinet. Catal. 11, 677 (1970); tr. of Kinet. Katal. 11, 821 (1970)

Dolgov-Savel'ev, G. G., Polyakov, V. A., and Chumak, G. M., "Laser Emission in the 2.8μ Range Involving Vibration-Rotation Transitions in the HF Molecule," Sov. Phys. JETP 31, 643 (1970); tr. of Zh. Eksp. Teor. Fiz. 58, 1197 (1970)

Dolgov-Savel'ev, G. G., Zharov, V. F., Neganov, Yu. S., and Chumak, G. M., "Vibrational-Rotational Transitions in an $H_2 + F_2$ Chemical Laser," Sov. Phys. JETP 34, 34 (1972); tr. of Zh. Eksp. Teor. Fiz. 61, 64 (1971)

Donovan, R. J., Husain, D., and Stevenson, C. D., "Vibrational Relaxation of HBr(v" = 1) at 300K," Trans. Faraday Soc. 66, 2148 (1970)

Duewer, W. H., and Setser, D. W., "Infrared Chemiluminescence and Energy Partitioning from Reactions of Fluorine Atoms with Hydrides of Carbon, Silicon, Oxygen, Sulfur, Nitrogen, and Phosphorus," J. Chem. Phys. 58, 2310 (1973)

Dzhidzhoev, M. S., Platonenko, V. T., and Khokhlov, R. V., "Chemical Lasers," Soviet Phys. Usp. 13, 247 (1970); tr. of Usp. Fiz. Nauk 100, 641 (1970)

Emanuel, G., and Whittier, J. S., "Closed-Form Solution to Rate Equations for an $F + H_2$ Laser Oscillator," Appl. Opt. 11, 2047 (1972)

Emanuel, G., Cohen, N., and Jacobs, T. A., "Theoretical Performance of an HF Chemical cw Laser," Aerospace Corp., El Segundo, Calif., SAMSO-TR-72-154 (Feb. 1972) (National Techn. Information Service, AD746685)

Fass, R. A., Hoover, J. W., and Simpson, L. M., "Photochemical Production of Hot Hydrogen and Deuterium Atoms. Reactions with Hydrogen Halides and Halogens," J. Phys. Chem. 76, 2801 (1972)

Ferguson, M. G., and Read, A. W., "Vibrational Relaxation of Hydrogen Chloride, Deuterium Chloride and Hydrogen Bromide at Room Temperature," Trans. Faraday Soc. 63, 61 (1967)

Fettis, G. C., and Knox, J. H., "The Rate Constants of Halogen Atom Reactions," Prog. Reaction Kinetics 2, 2 (1964)

Fettis, G. C., Knox, J. H., and Trotman-Dickenson, A. F., "The Reactions of Fluorine Atoms with Alkanes," J. Chem. Soc. 1064 (1960)

Findlay, F. D., and Polanyi, J. C., "The Hydrogen-Chlorine System in the MM Pressure Range. I. Energy Distribution among Vibrationally Excited States," Can. J. Chem. 42, 2176 (1964)

Findlay, F. D., and Polanyi, J. C., "General Discussion," Discussions Faraday Soc. 33, 274 (1962)

Falk, T. J., "Parametric Studies of the DF-CO_2 Chemical Transfer Laser," Cornell Aero. Lab., Inc., Air Force Weapons Lab., Kirtland AFB, New Mexico, Tech. Report AFWL-TR-71-96 (June 1972) (National Techn. Information Service, AD745450)

Freeman, C. G., and Phillips, L. F., "Kinetics of Chlorine Oxide Reactions. III. The Reaction of Hydrogen Atoms with Cl_2O," J. Phys. Chem. 72, 3031 (1968)

Fried, S. S., Wilson, J., and Taylor, R. L., "MA7-Measurement of the Temperature Dependence of the Vibrational Relaxation Rate of HF and the Effect of SF_6, N_2, and F_2 as Diluents," IEEE J. Quant. Electr. QE-9, 59 (1973)

Galante, J. J., and Gislason, E. A., "Critical Re-examination of the Reaction Cl + H_2 ⇌ HCl + H^*," Chem. Phys. Ltrs. 18, 231 (1973)

Gensel, P., Kompa, K. L., and Wanner, J., "IF_5-H_2 Hydrogen Fluoride Chemical Laser Involving a Chain Reaction," Chem. Phys. Ltrs. 5, 179 (1970)

Glaze, J. A., Finzi, J., and Krupke, W. F., "A Transverse Flow cw HCl Chemical Laser," Appl. Phys. Ltrs. 18, 173 (1971)

Gordon, R. J., and Lin, M. C., "The Mechanism of HF Laser Emission from the CHF + O_2 Reaction," Am. Chem. Soc., 166th Nat'l. Meeting, Abstr. Papers, 166, PHYS-137 (1973)

Gorshkov, V. I., Gromov, V. V., Igohin, V. I., Koshelev, E. L., Markin, E. P., and Oraevsky, A. N., "Investigation of Vibrational Relaxation in the Hydrogen Chloride Chemical Laser," Appl. Opt. 10, 1781 (1971)

Green, W. H., and Hancock, J. K., "MA1-Laser-Excited Vibrational Energy Transfer Studies of HF, CO, and NO," IEEE J. Quant. Electr. QE-9, 50 (1973)

Green, W. H., and Lin, M. C., "Pulsed Discharge Initiated Chemical Lasers. Part II. HF Laser Emission from NF_3 and N_2F_4 Systems," IEEE J. Quant. Electr. QE-7, 98 (1971)

Green, W. H., and Lin, M. C., "Pulsed-Discharge-Initiated Chemical Lasers. III. Complete Population Inversion in HF," J. Chem. Phys. 54, 3222 (1971)

Gregg, D. W., Krawetz, B., Pearson, R. K., Schleicher, B. R., Thomas, S. J., Huss, E. B., Pettipiece, K. J., Creighton, J. R., Niver, R. E., and Pan, Y.-L., "Electron Beam and Flashlamp Initiation of a Pulsed Hydrogen Fluoride Chemical Laser," Chem. Phys. Ltrs. 8, 609 (1971)

Gross, R. W. F., "Chemically Pumped CO_2 Laser," J. Chem. Phys. 50, 1889 (1969)

Gross, R. W. F., Cohen, N., and Jacobs, T. A., "HF Chemical Laser Produced by Flash Photolysis of F_2O-H_2 Mixtures," J. Chem. Phys. 48, 3821 (1968)

Gross, R. W. F., Giedt, R. R., and Jacobs, T. A., "Stimulated Emission behind Overdriven Detonation Waves in F_2O-H_2 Mixtures," J. Chem. Phys. 51, 1250 (1969); also, see Gross, R. W. F., Giedt, R. R., and Jacobs, T. A., "Stimulated Emission behind Overdriven Detonation Waves in F_2O-H_2 Mixtures," IEEE J. Quant. Electr. QE-6, 168 (1970)

Hancock, J. K., and Green, W. H., "Laser-Excited Vibrational Relaxation Studies of Hydrogen Fluoride," J. Chem. Phys. 56, 2474 (1972)

Hancock, J. K., and Green, W. H., "Vibrational Deactivation of HF(v=1) in Pure HF and in HF-Additive Mixtures," J. Chem. Phys. 57, 4515 (1972)

Henry, A., Bourgin, F., Arditi, I., Charneau, R., and Menard, J., "Effet Laser par Réaction Chimique de l'Hydrogène sur du Chlore ou du Chlorure de Nitrosyle," Compt. Rend. B 267, 616 (1968)

Henry, J. M., Anderson, J. B., and Jaffe, R. I., "Molecular Dynamics of the Hydrogen-Iodine Reaction System," Chem. Phys. Ltrs. 20, 138 (1973)

Herbelin, J. M., and Cohen, N., "The Chemical Production of Electronically Excited States in the H/NF_2 System," Chem. Phys. Ltrs. 20, 605 (1973)

Hess, L. D., "Enhanced Initiation and High Pressure Operation of the HF Chemical Laser," IEEE J. Quant. Electr. QE-9, 201 (1973)

Hess, L. D., "HF Chemical Laser Studies: Use of MoF_6 to Increase Reaction Rates in H_2-F_2 Mixtures," J. Appl. Phys. 43, 1157 (1972)

Hess, L. D., "Pulsed Laser Emission Chemically Pumped by the Chain Reaction between Hydrogen and Fluorine," J. Chem. Phys. 55, 2466 (1971)

Heydtmann, H., and Polanyi, J. C., "Energy Distribution among Reaction Products: H + SCl_2 → HCl + SCl," Appl. Opt. 10, 1738 (1971)

Heydtmann, H., Polanyi, J. C., and Taguchi, R. T., "Infrared-Emission Studies of Electronic-to-Vibrational Energy Transfer. IV: Hg^* + HF," Appl. Opt. 10, 1755 (1971)

Hinchen, J. J., "Vibrational Relaxation of Hydrogen and Deuterium Fluorides," J. Chem. Phys. 59, 233 (1973);

also, see Hinchen, J. J., "Vibrational Relaxation of Hydrogen Fluoride and Deuterium Fluoride," IEEE J. Quant. Electr. QE-9, 196 (1973)

Homann, K. H., Solomon, W. C., Warnatz, J., Wagner, H. Gg., and Zetzsch, C., "Eine Methode zur Erzeugung von Fluoratomen in inerter Atmosphäre," Ber. Bunseng. Physik. Chem. 74, 585 (1970)

Hopkins, B. M., Baronavski, A., and Chen, H.-L., "Vibrational Relaxation of OCS in HBr, HCl, and Rare Gaseous Mixtures," J. Chem. Phys. 59, 836 (1973)

Hopkins, B. M., and Chen, H.-L., "Vibrational Excitation and Relaxation of HCl (V = 2) State," J. Chem. Phys. 57, 3816 (1972); also, see Hopkins, B. M., and Chen. H.-L., "Vibrational Excitation and Relaxation of HCl (V = 2) State," IEEE J. Quant. Electr. QE-9, 196 (1973)

Hopkins, B. M., and Chen, H.-L., "Vibrational Relaxation of Hydrogen," J. Chem. Phys. 57, 3161 (1972)

Hopkins, B. M., and Chen, H.-L., "Vibrational Relaxation of HBr (V = 1) State in Methane, Water, Helium, and Hydrogen Gaseous Mixtures," J. Chem. Phys. 59, 1495 (1973)

Igoshin, V. I., and Oraevskii, A. N., "Kinetics of an HCl Chemical Laser," High Energy Chem. 5, 357 (1971); tr. of Khim. Vys. Energ. 5, 397 (1971)

Jacobson, T. V., and Kimbell, G. H., "Transversely Pulse-Initiated Chemical Lasers: Preliminary Performance of the HF System," Chem. Phys. Ltrs. 8, 309 (1971)

Jacobson, T. V., and Kimbell, G. H., "Transversely Pulse-Initiated Chemical Lasers: Atmospheric-Pressure Operation of an HF Laser," J. Appl. Phys. 42, 3402 (1971)

Jaffe, R. L., and Anderson, J. B., "Classical Trajectory Analysis of the Reaction $F + H_2 \rightarrow HF + H$," J. Chem. Phys. 54, 2224 (1971)

Jaffe, R. L., Henry, J. M., and Anderson, J. B., "Variational Theory of Reaction Rates: Application to $F + H_2 = HF + H$," J. Chem. Phys. 59, 1128 (1973)

Jensen, R. J., and Rice, W. W., "Electric Discharge Initiated SF_6-H_2 and SF_6 - HBr Chemical Lasers," Chem. Phys. Ltrs. 7, 627 (1970)

Jensen, R. J., and Rice, W. W., "Thermally Initiated HF Chemical Laser," Chem. Phys. Ltrs. 8, 214 (1971)

Johnson, R. L., "Infrared Chemiluminescence from H + SCl_2, H + S_2Cl_2, H + $SOCl_2$ and H + SO_2Cl_2," Diss. Abstr. Int. B 30, 2632 (1969)

Johnson, R. L., Kim, K. C., and Setser, D. W., "Trajectory Studies of Abstraction Reactions. Fluorine Atoms with Substituted Methanes and Deuterium Atoms with Chloroiodide," J. Phys. Chem. 77, 2499 (1973)

Johnson, R. L., Perona, M. J., and Setser, D. W., "Hydrogen Chloride Vibrational Populations Produced by the H and D Atom Reactions with SCl_2 and S_2Cl_2," J. Chem. Phys. 52, 6372 (1970)

Johnson, R. L., and Setser, D. W., "Infrared Chemiluminescence from Hydrogen Atom Reactions with the Sulfur-Chlorine Bond," Chem. Phys. Ltrs. 3, 207 (1969)

Jonathan, N., Melliar-Smith, C. M., Okuda, S., Slater, D. H., and Timlin, D., "Initial Vibrational Energy Level Distributions Determined by Infra-red Chemiluminescence. II. The Reaction of Fluorine Atoms with Hydrogen Halides," Mol. Phys. 22, 561 (1971)

Jonathan, N., Melliar-Smith, C. M., and Slater, D. H., "Infrared Emission from the Reaction of Atomic Fluorine with Hydrogen Chloride - A Possible New Chemical Laser System," Chem. Phys. Ltrs. 7, 257 (1970)

Jonathan, N., Melliar-Smith, C. M., and Slater, D. H., "Initial Vibrational Energy Level Populations Resulting from the Reaction H + F_2 as Studied by Infrared Chemiluminescence," J. Chem. Phys. 53, 4396 (1970)

Jonathan, N., Melliar-Smith, C. M., and Slater, D. H., "Initial Vibrational Energy Distributions Determined by Infra-red Chemiluminescence. I. The Reaction of Fluorine Atoms with Hydrogen and Methane," Mol. Phys. 20, 93 (1971)

Jonathan, N., Melliar-Smith, C. M., Timlin, D., and Slater, D. H., "Analysis of Hydrogen Fluoride Infrared Chemiluminescence from Simple Atom-Molecule Reactions," Appl. Opt. 10, 1821 (1971)

Jonathan, N., Okuda, S., and Timlin, D., "Initial Vibrational Energy Distributions Determined by Infra-red Chemiluminescence. III. Experimental Results and Classical Trajectory Calculations for the H + F_2 System," Mol. Phys. 24, 1143 (1972)

Jost, W., "Der Einfluss des Druckes Auf Die Photochemische Bromwasserstoffbildung. II.," Zeit. Phys. Chem. B 3, 95 (1929)

Just, T., and Rimpel, G., "Studies on HF Relaxation and on the Reaction of H_2 with F_2 Behind Shocks," IEEE J. Quant. Electr. QE-9, 196 (1973)

Kapralova, G. A., and Chaikin, A. M., "Evidence of the Non-Thermal Origin of Second Limit of Self-Ignition in Reaction between Fluorine and Hydrogen," Combust. Flame 13, 557 (1969)

Kapralova, G. A., and Chaikin, A. M., "Evidence for the Nonthermal Nature of the Upper Ignition Limit in the Reaction Between Fluorine and Hydrogen," Kinet. Catal. 10, 195 (1969); tr. of Kinet. Katal. 10, 245 (1969)

Kapralova, G. A., Margolina, E. M., and Chaikin, A. M., "Rate Constants of Several Reactions of Vibrationally Excited Hydrogen Molecules in the Reaction of Fluorine with Hydrogen," Dokl. Phys. Chem. 197, 281 (1971); tr. of Dokl. Akad. Nauk SSSR 197, 624 (1971)

Kapralova, G. A., Margolina, E. M., and Chaikin, A. M., "Mechanism of the Reaction of Fluorine with Hydrogen," Dokl. Phys. Chem. 198, 452 (1971); tr. of Dokl. Akad. Nauk SSSR 198, 634 (1971)

Kapralova, G. A., Margolina, E. M., and Chaikin, A. M., "The Effect of Fluorine, Hydrogen, or Inert Gases on the

Upper Self-Ignition Limit in the Reaction of Fluorine with Hydrogen," Kinet. Catal. 10, 23 (1969); tr. of Kinet. Katal. 10, 32 (1969)

Kapralova, G. A., Margolin, A. L., and Chaikin, A. M., "Activation Energy of the Reaction Between a Fluorine Atom and a Hydrogen Molecule," Kinet. Catal. 11, 669 (1970); tr. of Kinet. Katal. 11, 810 (1970)

Kapralova, G. A., Nikitin, E. E., and Chaikin, A. M., "Non-Empirical Calculations of the Probabilities of Vibrational Transitions in Hydrogen Halide Molecules," Chem. Phys. Ltrs. 2, 581 (1968)

Kapralova, G. A., Trofimova, E. M., Rusin, L. Yu., Chaikin, A. M., and Shilov, A. E., "Experimental Proofs of Branching in Chain Reactions of Molecular Fluorine," Kinet. Catal. 4, 567 (1963); tr. of Kinet. Katal. 4, 653 (1963)

Kapralova, G. A., Trofimova, E. M., and Shilov, A. E., "The Upper Ignition Limit in the Reaction of Fluorine with Hydrogen," Kinet. Catal. 6, 884 (1964); tr. of Kinet. Katal. 6, 977 (1964)

Kasper, J. V. V., "Infrared Chemiluminescence and Stimulated Emission," Diss. Abstr. 26, 5062 (1966)

Kasper, J. V. V., and Pimentel, G. C., "HCl Chemical Laser," Phys. Rev. Ltrs. 14, 352 (1965)

Kerber, R. L., Cohen, N., and Emanuel, G., "A Kinetic Model and Computer Simulation for a Pulsed DF-CO_2 Chemical Transfer Laser," IEEE J. Quant. Electr. QE-9, 94 (1973)

Kerber, R. L., Emanuel, G., and Whittier, J. S., "Computer Modeling and Parametric Study for a Pulsed H_2 + F_2 Laser," Appl. Opt. 11, 1112 (1972)

Kerber, R. L., Emanuel, G., and Whittier, J. S., "Cavity and Chemical Mechanisms in a H_2 + F_2 Pulsed Laser," IEEE J. Quant. Electr. QE-9, 190 (1973)

Kerber, R. L., and Whittier, J. S., "The Effect of Various Parameters on the Behavior of the Pulsed HF Chemical Laser," The Aerospace Corp., El Segundo, Calif., Report No. TOR-0059(6753-10)-1 (December 1970)

Kiefer, J. H., Breshears, W. D., and Bird, P. F., "Vibrational Relaxation of HBr and HI in Shock Waves," J. Chem. Phys. 50, 3641 (1969)

Kim, K. C., and Setser, D. W., "Infrared Chemiluminescence and Energy Partitioning from Reactions of Fluorine Atoms with Hydride Molecules," Am. Chem. Soc., 166th Nat'l. Meeting, Abstr. Papers 166, PHYS-99 (1973)

Kim, K. C., and Setser, D. W., "HF and DF Infrared Chemiluminescence and Energy Partitioning from the Reactions of Fluorine Atoms with C_6-C_{10} Cycloalkanes and Propane-d_6," J. Phys. Chem. 77, 2493 (1973)

Kirsch, L. J., and Polanyi, J. C., "Effect of Reagent Vibrational Excitation on Reaction Rate and Product Energy Distribution in F + HCl → HF + Cl," J. Chem. Phys. 57, 4498 (1972)

Klein, F. S., Persky, A., and Weston, R. E., Jr., "Deuterium-Isotope Effect in the Chlorine Exchange between Hydrogen Chloride and Chlorine Atoms. A Study of Models for the Tunnel Effect," J. Chem. Phys. 41, 1799 (1964)

Klein, F. S., and Wolfsberg, M., "Competitive Reaction Rates of Hydrogen Atoms with HCl and Cl_2, Entropy Considerations of the HCl_2 Transition State," J. Chem. Phys. 34, 1494 (1961)

Klimek, D. F., and Berry, M. J., "The Formyl Fluoride Photochemical Laser: Photochemistry and Energy Content of the HF Photoelimination Product," Chem. Phys. Ltrs. 20, 141 (1973); Supersedes Am. Chem. Soc. 166th Nat'l. Meeting, Abstr. Papers 166, PHYS-103 (1973)

Knox, J. H., and Nelson, R. L., "Competitive Chlorination Reactions in the Gas Phase: Hydrogen and C_1-C_5 Saturated Hydrocarbons," Trans. Faraday Soc. 55, 937 (1959)

Kompa, K. L., "Chemical Lasers," Angew. Chem., Intern. Ed. 9, 773 (1970)

Kompa, K. L., "Chemische Lasers," Chem. Ingr.-Techn. 42, 573 (1970)

Kompa, K. L., Gensel, P., and Wanner, J., "New Hydrogen Fluoride Chemical Lasers," Chem. Phys. Ltrs. 3, 210 (1969)

Kompa, K. L., Parker, J. H., and Pimentel, G. C., "UF_6-H_2 Hydrogen Fluoride Chemical Laser: Operation and Chemistry," J. Chem. Phys. 49, 4257 (1968)

Kompa, K. L., and Pimentel, G. C., "Hydrofluoric Acid Chemical Laser," J. Chem. Phys. 47, 857 (1967)

Kompa, K. L., and Wanner, J., "Study of Some Fluorine Atom Reactions using a Chemical Laser Method," Chem. Phys. Ltrs. 12, 560 (1972)

Kompa, K. L., Wanner, J., and Gensel, P., "New Hydrogen Fluoride Chemical Lasers - A Comparison," IEEE J. Quant. Electr. QE-6, 185 (1970)

Krogh, O. D., and Pimentel, G. C., "Chemical Lasers from the Reactions of ClF and ClF_3 with H_2 and CH_4: A Possible Chain-Branching Chemical Laser," J. Chem. Phys. 56, 969 (1972)

Kwok, M. A., "HF Deactivation Kinetics using a Medium Pressure Flow Tube: HF + H_2 System," IEEE J. Quant. Electr. QE-9, 196 (1973)

Kwok, M. A., Giedt, R. R., and Gross, R. W. F., "Comparison of HF and DF Continuous Chemical Lasers: II. Spectroscopy," Appl. Phys. Ltrs. 16, 386 (1970); also, see Part I: Kwok, M. A., Giedt, R. R., Jacobs, T. A., Gross, R. W. F., and Spencer, D. J., "Spectroscopy of HF and DF Continuous Chemical Lasers," Aerospace Corp., El Segundo, Calif., (1970) (National Techn. Information Service, AD708468)

Leone, S. T., and Moore, C. B., "V → V Energy Transfer in HCl with Tunable Optical Parametric Oscillator Excitation," Chem. Phys. Ltrs. 19, 340 (1973)

Letokhov, V. S., "Use of Lasers to Control Selective Chemical Reactions," Science 180, 451 (1973)

Levine, R. D., Johnson, B. R., and Berstein, R. B., "On the Product Rotational State Distribution in Exoergic Atom-Diatomic Molecule Reactions," Chem. Phys. Ltrs. 19, 1 (1973)

Levy, J. B., and Copeland, B. K. W., "The Kinetics of the Thermal, Hydrogen-Fluorine Reaction. I. Magnesium Reactor," J. Phys. Chem. 67, 2156 (1963)

Levy, J. B., and Copeland, B. K. W., "The Kinetics of the Hydrogen-Fluorine Reaction. II. The Oxygen-Inhibited Reaction," J. Phys. Chem. 69, 408 (1965)

Levy, J. B., and Copeland, B. K. W., "The Kinetics of the Hydrogen-Fluorine Reaction. III. The Photochemical Reaction," J. Phys. Chem. 72, 3168 (1968)

Lin, M. C., "HCl Chemical Laser from H + Cl_2O," Chem. Phys. Ltrs. 7, 209 (1970)

Lin, M. C., "Chemical HCl and HF Lasers Produced from the Reactions of $O(^1D)$ Atoms with Chlorofluoromethanes," IEEE J. Quant. Electr. QE-9, 200 (1973)

Lin, M. C., "Chemical Lasers Produced from $O(^1D)$ Atom Reactions. II. A New Hydrogen Fluoride Elimination Laser from the $O(^1D)$ + CH_nF_{4-n} (n = 1, 2, and 3) Reactions," J. Phys. Chem. 75, 3642 (1971)

Lin, M. C., and Green, W. H., "Pulsed-Discharge-Initiated Chemical Lasers. I. HF Laser Emission from CHF_2Cl, $CHFCl_2$, CHF_3, and CF_2Cl_2-H_2 Systems," J. Chem. Phys. 53, 3383 (1970)

MacLean, D. I., and Tregay, G. W., "Structure of Fluorine Supported Flames. III. Vibrational Disequilibrium of

Third and Fourth Levels of HF in Dilute Low Pressure H_2-F_2 Flames," Boston College, Dept. Chemistry, Chestnut Hill, Mass., AFOSR-TR-71-2670 (Oct. 1971) (National Techn. Information Service, AD732927)

MacLean, D. I., and Tregay, G. W., "Spectroscopic Studies of Low-Pressure Hydrogen-Fluorine Flames," Symp. Combust. 14 (Combustion Institute, Pittsburgh, 1973) 157

Margottin-Maclou, M., Doyennette, L., and Henry, L., "Relaxation of Vibrational Energy in CO, HCl, CO_2, and N_2O," Appl. Opt. 10, 1768 (1971)

Mayer, S. W., Schieler, L., and Johnston, H. S., "Computation of High-Temperature Rate Constants for Bimolecular Reactions of Combustion Products," Symp. Combust. 11 (Combustion Institute, Pittsburgh, 1967) 837

Maylotte, D. H., and Polanyi, J. C., and Woodall, K. B., "Energy Distribution among Reaction Products. IV. X + HY(X ≡ Cl, Br; Y ≡ Br, I), Cl + DI," J. Chem. Phys. 57, 1547 (1972)

Meinzer, R. A., "A Continuous-Wave Combustion Laser," Int. J. Chem. Kinet. 2, 335 (1970)

Ménard-Bourcin, F., Ménard, J., and Henry, L., "Distribution de l'Énergie vibrationnelle entre les Molécules de Gaz Chlorhydrique au cours d'Une Réaction Chimique, Réaction du Chlore et de l'Hydrogéne," Compt. Rend. B 274, 241 (1972)

Mercer, P. D., and Pritchard, H. O., "The Gas Phase Fluorination of Hydrogen-Methane Mixtures," J. Phys. Chem. 63, 1468 (1959)

Miller, G., and Light, J. C., "Quantum Calculations of Collinear Reactive Triatomic Systems. III. H + Cl_2 → HCl + Cl," J. Chem. Phys. 54, 1643 (1971)

Mirels, H., and Spencer, D. J., "Power and Efficiency of a Continuous HF Chemical Laser," IEEE J. Quant. Electr. QE-7, 501 (1971)

Molina, M. J., and Pimentel, G. C., "Chemical Laser Studies of Vibrational Energy Distributions: The Equal-Gain and Zero-Gain Temperature Techniques," IEEE J. Quant. Electr. QE-9, 64 (1973)

Molina, M. J., and Pimentel, G. C., "Tandem Chemical Laser Measurements of Vibrational Energy Distribution in the Dichloroethylene Photoelimination Reactions," J. Chem. Phys. 56, 3988 (1972)

Moore, C. B., "Laser Studies of Vibrational Energy Transfer," Accounts Chem. Res. 2, 103 (1969)

Moore, C. B., "Vibration → Vibration Energy Transfer," Advan. Chem. Phys. 23, 41 (1973)

Moore, C. B., "Lasers in Chemistry," Ann. Rev. Phys. Chem. 22, 387 (1971)

Moore, C. B., "Laser Excited Vibrational Fluorescence and Its Application to Vibration → Vibration Energy Transfer in Gases," in "Fluorescence: Theory, Instrumentation, and Practice," G. G. Guilbault, Ed., (Marcel Dekker, Inc., New York, 1967) 133

Moore, C. B., "An Electrically Pulsed HCl Laser," IEEE J. Quant. Electr. QE-4, 52 (1968)

Moore, C. B., "Vibration-Rotation Energy Transfer," J. Chem. Phys. 43, 2979 (1965)

Moore, C. B., and Zittel, P. F., "State-Selected Kinetics from Laser-Excited Fluorescence," Science 182, 541 (1973)

Muckerman, J. T., "Monte Carlo Calculations of Energy Partitioning and Isotope Effects in Reactions of Fluorine Atoms with H_2, HD, and D_2 [Part I]," J. Chem. Phys. 54, 1155 (1971)

Muckerman, J. T., "Classical Dynamics of the Reaction of Fluorine Atoms with Hydrogen Molecules. II. Dependence on the Potential Energy Surface," J. Chem. Phys. 56, 2997 (1972)

Muckerman, J. T., "Classical Dynamics of the Reaction of Fluorine Atoms with Hydrogen Molecules. III. The Hot-Atom Reactions of ^{18}F with HD," J. Chem. Phys. 57, 3388 (1972)

Muckerman, J. T., and Newton, M. D., "Comment on 'Multiple Potential Energy Surfaces for Reactions of Species in Degenerate Electronic States' by D. G. Truhlar," J. Chem. Phys. 56, 3191 (1972)

Naegeli, D. W., and Ultee, C. J., "A cw HCl Chemical Laser," Chem. Phys. Ltrs. 6, 121 (1970)

Norrish, R. G. W., "The Progress of Photochemistry Exemplified by Reactions of the Halogens," Proc. Roy. Soc. (London), A 301, 1 (1967)

O'Neil, S. V., Pearson, P. K., Schaefer, H. F., and Bender, C. F., "On the H + F_2 → HF + F Reaction. An 'ab initio' Potential Energy Surface," J. Chem. Phys. 58, 1126 (1973)

Osgood, R. M., Jr., and Javan, A., "Measurements of the HF Vibration-Vibration Transfer Time and Apparent Vibration Decay Rate of v = 2 Using Observation of the v = 2 v = 1 Fluorescence in HF," IEEE J. Quant. Electr. QE-9, 190 (1973)

Osgood, R. M., Jr., Javan, A., and Sackett, D. B., "Measurement of Vibration-Vibration Energy Transfer Time in HF Gas," Appl. Phys. Ltrs. 20, 469 (1972)

Pacey, P. D., and Polanyi, J. C., "Energy Distribution among Reaction Products. III: The Method of Measured Relaxation Applied to H + Cl_2," Appl. Opt. 10, 1725 (1971)

Padrick, T. D., and Pimentel, G. C., "Addition-Elimination HF Chemical Laser," Appl. Phys. Ltrs. 20, 167 (1972)

Padrick, T. D., and Pimentel, G. C., "Hydrogen Fluoride Elimination Chemical Laser from N,N-Difluoromethylamine," J. Chem. Phys. 54, 720 (1971)

Pan, Y.-L., Turner, C. E., Jr., and Pettipiece, K. J., "The Characteristics of an Electron-Beam-Initiated Pulsed Chemical Laser," Chem. Phys. Ltrs. 10, 577 (1971)

Parker, J. H., and Pimentel, G. C., "Some New UF_6-RH Hydrogen Fluoride Chemical Lasers and a Preliminary Analysis of the Chloroform System," IEEE J. Quant. Electr. QE-6, 175 (1970)

Parker, J. H., and Pimentel, G. C., "Hydrogen Fluoride Chemical Laser Emission through Hydrogen-Atom Abstraction from Hydrocarbons," J. Chem. Phys. 48, 5273 (1968)

Parker, J. H., and Pimentel, G. C., "Vibrational Energy Distribution through Chemical Laser Studies. I. Fluorine Atoms plus Hydrogen or Methane," J. Chem. Phys. 51, 91 (1969)

Parker, J. H., and Pimentel, G. C., "Vibrational Energy Distribution through Chemical Laser Studies. II. Fluorine Atoms plus Chloroform," J. Chem. Phys. 55, 857 (1971)

Parker, J. V., "Vibrational Deactivation of HF in the H_2-F_2 Chain Reaction," IEEE J. Quant. Electr. QE-9, 189 (1973)

Parr, C. A., Polanyi, J. C., and Wong, W. H., "Distribution of Reaction Products (Theory). VIII. Cl + HI, Cl + DI," J. Chem. Phys. 58, 5 (1973)

Parr, C. A., and Truhlar, D. G., "Potential Energy Surfaces for Atom Transfer Reactions Involving Hydrogens and Halogens," J. Phys. Chem. 75, 1844 (1971)

Pearson, R. K., Cowles, J. O., Hermann, G. L., Pettipiece, K. J., and Gregg, D. W., "Pressure Dependency of the NF_3-H_2 Transverse-Discharge Pulse-Initiated HF Chemical Laser," IEEE J. Quant. Electr. QE-9, 723 (1973)

Penzhorn, R. D., and Darwent, B. de B., "The Reaction of Hydrogen Atoms with Hydrogen Iodide," J. Phys. Chem. 72, 1639 (1968)

Perona, M. J., "Infrared Chemiluminescence from the Reaction of Hydrogen Atoms with Oxygen Difluoride," J. Chem. Phys. 54, 4024 (1971)

Perona, M. J., Setser, D. W., and Johnson, R. J., "Infrared Chemiluminescence from the Reaction of Hydrogen Atoms with SCl_2, S_2Cl_2, $SOCl_2$, SO_2Cl_2, and OCl_2," J. Chem. Phys. 52, 6384 (1970)

Perona, M. J., Setser, D. W., and Johnson, R. L., "Identification of the Competitive Elementary Reaction of Hydrogen Atoms with Chlorine Monoxide by Infrared Chemiluminescence," J. Phys. Chem. 73, 2091 (1969)

Persky, A., "Kinetic Isotope Effects in the Reaction of Fluorine Atoms with Molecular Hydrogen. I. H_2/D_2 Kinetic Isotope Effect," J. Chem. Phys. 59, 3612 (1973)

Pimentel, G. C., "Chemical Information from Chemical Lasers," Dansk Kemi 50, 1 (1969)

Pimentel, G. C., "The Significance of Chemical Lasers in Chemistry," IEEE J. Quant. Electr. QE-6, 174 (1970)

Pimentel, G. C., "Reply to Comment on 'Chemical Lasers from the Reactions of ClF and ClF_3 with H_2 and CH_4: A Possible Chain-Branching Chemical Laser'," J. Chem. Phys. 58, 1270 (1973); also, see Krogh, O. D., and Pimentel, G. C., "Chemical Lasers from the Reactions of ClF and ClF_3 with H_2 and CH_4: A Possible Chain-Branching Chemical Laser," J. Chem. Phys. 56, 969 (1972) and Suchard, S. N., "Comment on 'Chemical Lasers from the Reactions of ClF and ClF_3 with H_2 and CH_4: A Possible Chain-Branching Chemical Laser," J. Chem. Phys. 58, 1269 (1973)

Pimentel, G. C., "Infrared Study of Transient Molecules in Chemical Lasers," Pure Appl. Chem. 18, 275 (1969)

Pimentel, G. C., "Chemical Lasers," Sci. Am. 214, No. 4, 32 (1966)

Pirkle, J. C., Jr., and McGee, H. A., Jr., "Perturbed Morse-Oscillator Approximation in Reactive Collisions. I. An Attractive Potential," J. Chem. Phys. 49, 3532 (1968)

Polanyi, J. C., "Vibrational-Rotational Population Inversion," Appl. Opt. Suppl. 2, 109 (1965)

Polanyi, J. C., "Energy Distribution Among Reaction Products, and Infrared Chemiluminescence," Chem. Britain 2, 151 (1966)

Polanyi, J. C., "General Discussion," Discussions Faraday Soc. 33, 279 (1962)

Polanyi, J. C., "The Conversion of Reaction Energy into Product Vibration and Rotation," IEEE J. Quant. Electr. QE-6, 168 (1970)

Polanyi, J. C., "Energy Distribution Among Reagents and Products of Atomic Reactions," J. Chem. Phys. 31, 1338 (1959)

Polanyi, J. C., "Proposal for an Infrared Maser Dependent on Vibrational Excitation," J. Chem. Phys. 34, 347 (1961)

Polanyi, J. C., "Infrared Chemiluminescence," J. Quant. Spectry. Radiative Transfer 3, 471 (1963)

Polanyi, J. C., and Rosner, S. D., "Energy Distribution among Products of Exothermic Reaction," J. Chem. Phys. 38, 1028 (1963)

Polanyi, J. C., and Sloan, J. J., "Energy Distribution among Reaction Products. VII. $H + F_2$," J. Chem. Phys. 57, 4988 (1972)

Polanyi, J. C., and Tardy, D. C., "Energy Distribution in the Exothermic Reaction $F + H_2$ and the Endothermic Reaction $HF + H$," J. Chem. Phys. 51, 5717 (1969)

Polanyi, J. C., and Woodall, K. B., "Mechanism of Rotational Relaxation," J. Chem. Phys. 56, 1563 (1972)

Polanyi, J. C., and Woodall, K. B., "Energy Distribution among Reaction Products. VI. F + H_2, D_2," J. Chem. Phys. 57, 1574 (1972)

Pummer, H., and Kompa, K. L., "Investigation of a 1-J Pulsed Discharge-Initiated HF Laser," Appl. Phys. Ltrs. 20, 356 (1972)

Rabideau, S. W., "Atom-Molecule Kinetics. The H + ClF_3 Reaction," J. Chem. Phys. 59, 1533 (1973)

Rabinovitch, B. S., and Flowers, M. C., "Chemical Activation," Chem. Soc., Quart. Rev. 18, 122 (1964)

Raff, L. M., Sims, L. B., Thompson, D. L., and Porter, R. N., "Dynamic Effects in Exchange Reactions: Dependence of Thermal Rate Constants upon Vibrational Excitation," J. Chem. Phys. 53, 1606 (1970)

Rankin, C. C., and Light, J. C., "Quantum Solution of Collinear Reactive Systems: H + Cl_2 → HCl + Cl," J. Chem. Phys. 51, 1701 (1969)

Rice, W. W., and Jensen, R. J., "Evaluation of Chemical Lasers Based on ClN_3," IEEE J. Quant. Electr. QE-9, 199 (1973)

Ridley, B. A., and Smith, I. W. M., "The Vibrational Relaxation of HCl (v = 3, 2 and 1) by Cl Atoms," Chem. Phys. Ltrs. 9, 457 (1971)

Ridley, B. A., and Smith, I. W. M., "Quenching of Infra-red Chemiluminescence. Part 2. Rates of Energy Transfer from HCl($v \leq 3$) to HBr, HCl and CO_2," J. Chem. Soc., Faraday Trans. II 68, 1231 (1972)

Roebber, J. L., and Pimentel, G. C., "Tandem Laser Studies of the Vibrational Energy Distribution in Hydrogen Fluoride Formed by the Reaction of Methylene with Methyl Fluoride," IEEE J. Quant. Electr. QE-9, 201 (1973)

Ross, D. S., and Shaw, R., "The Kinetics of the Unimolecular Dehydrofluorination of Methyldifluoramine," J. Phys. Chem. 75, 1170 (1971)

Russell, D., and Light, J. C., "Classical Calculations of Linear Reactive Systems: $H + Cl_2 \rightarrow HCl + Cl$," J. Chem. Phys. 51, 1720 (1969)

Schafer, T. P., Siska, P. E., Parson, J. M., Tully, F. P., Wong, Y. C., and Lee, Y. T., "Crossed Molecular Beam Study of $F + D_2$," J. Chem. Phys. 53, 3385 (1970)

Schatz, G. C., Bowman, J. M., and Kuppermann, A., "Large Quantum Effects in the Collinear $F + H_2 \rightarrow FH + H$ Reaction," J. Chem. Phys. 58, 4023 (1973)

Seery, D. J., "Vibrational Relaxation of HCl with Inert Gas Collision Partners," J. Chem. Phys. 58, 1796 (1973)

Semenov, N. N., and Shilov, A. E., "On the Role of Excited Particles in Branched Chain Reactions," Kinet. Catal. 6, 1 (1964); tr. of Kinet. Katal. 6, 3 (1964)

Sentman, L. H., "Vibration-to-Rotation and Vibration-to-Vibration Energy Transfer between Diatomic Molecules," Chem. Phys. Ltrs. 18, 493 (1973)

Sentman, L. H., and Solomon, W. C., "Kinetics of the Vibrational Relaxation of the $HF-N_2$ System," J. Chem. Phys. 59, 89 (1973)

Sharma, R. D., and Chen. H.-L., "Vibration-to-Vibration Energy Transfer in HCl and HBr," J. Chem. Phys. 58, 3519 (1973)

Shin, H. K., "Vibration-Rotation-Translation Energy Transfer in HF-HF and DF-DF," Chem. Phys. Ltrs. 10, 81 (1971); Erratum: ibid 11, 628 (1971)

Shin, H. K., "Formulation of Vibration-Rotation Energy Transfer Probability," Chem. Phys. Ltrs. 6, 494 (1970)

Shin, H. K., "Temperature Dependence of the Probability of Vibrational Energy Transfer between HF and F," Chem. Phys. Ltrs. 14, 64 (1972)

Shin, H. K., "Excitation of Molecular Vibration on Collision. I. Preferential Orientations for Vibrational Transitions," J. Chem. Phys. 49, 3964 (1968)

Shin, H. K., "Vibration-to-Rotation Energy Transfer in Hydrogen Fluoride: Effects of the Dipole-Dipole and Hydrogen-Bond Interactions," J. Chem. Phys. 59, 879 (1973)

Shin, H. K., "Deexcitation of Molecular Vibration on Collision: Vibration-to-Rotation Energy Transfer in Hydrogen Halides," J. Phys. Chem. 75, 1079 (1971)

Shizgal, B., and Karplus, M., "Nonequilibrium Contribution to the Rate of Reaction. III. Isothermal Multicomponent Systems," J. Chem. Phys. 54, 4357 (1971)

Shuler, K. E., Carrington, T., and Light, J. C., "Nonequilibrium Chemical Excitation and Chemical Pumping of Lasers," Appl. Opt. Suppl. 2, 81 (1965)

Slootmaekers, P. J., and van Tiggelen, A., "Fluorine and Chlorine Flames," Bull. Soc. Chim. Belg. 67, 135 (1958)

Smith, I. W. M., and Wood, P. M., "Vibrational Relaxation in Atom-Exchange Reactions: A Classical, Monte Carlo, Trajectory Study," Mol. Phys. 25, 441 (1973)

Snider, N. S., "Rate Constants for Cl + H_2 → HCl + H," J. Chem. Phys. 53, 4116 (1970); also, see Westenberg, A. A., and de Haas, N., "Atom-Molecule Kinetics using ESR Detection. IV. Results for Cl + H_2 → HCl + H in Both Directions," J. Chem. Phys. 48, 4405 (1968) and Westenberg, A. A., "Reply to Comment by N. S. Snider," J. Chem. Phys. 53, 4117 (1970)

Solomon, W. C., Blauer, J. A., Jaye, F. C., and Hnat, J. G., "The Vibrational Excitation of Hydrogen Fluoride Behind Incident Shock Waves," Int. J. Chem. Kinet. 3, 215 (1971)

Spencer, D. J., Jacobs, T. A., Mirels, H., and Gross, R. W. F., "Continuous-Wave Chemical Laser," Int. J. Chem. Kinet. 1, 493 (1969)

Spinnler, J. F., and Kittle, P. A., "Hydrogen Fluoride Chemical Laser - A Demonstration of Pure Chemical Pumping," IEEE J. Quant. Electr. QE-6, 169 (1970)

Stedman, D. H., Steffenson, D., and Niki, H., "The Reaction between Active Hydrogen and Cl_2. Evidence for the Participation of Vibrationally Excited H_2," Chem. Phys. Ltrs. 7, 173 (1970)

Stephens, R. R., and Cool, T. A., "Vibrational Energy Transfer and De-Excitation in the HF, DF, HF-CO_2, and DF-CO_2 Systems," J. Chem. Phys. 56, 5863 (1972)

Stephenson, J. C., Finzi, J., and Moore, C. B., "Vibration → Vibration Energy Transfer in CO_2-Hydrogen Halide Mixtures," J. Chem. Phys. 56, 5214 (1972)

Stern, M. J., Persky, A., and Klein, F. S., "Force Field and Tunneling Effects in the H-H-Cl Reaction System. Determination from Kinetic-Isotope-Effect Measurements," J. Chem. Phys. 58, 5697 (1973)

Suchard, S. N., "Comment on 'Chemical Lasers from the Reactions of ClF and ClF_3 with H_2 and CH_4: A Possible Chain-Branching Chemical Laser'," J. Chem. Phys. 58, 1269 (1973); also, see Krogh, O. D., and Pimentel, G. C., "Chemical Lasers from the Reactions of ClF and ClF_3 with H_2 and CH_4: A Possible Chain-Branching Chemical Lasers," J. Chem. Phys. 56, 969 (1972) and Pimentel, G. C., "Reply to Comment on 'Chemical Lasers from the Reactions of ClF and ClF_3 with H_2 and CH_4: A Possible Chain-Branching Chemical Laser," J. Chem. Phys. 58, 1270 (1973)

Suchard, S. N., Gross, R. W. F., and Whittier, J. S., "Time-Resolved Spectroscopy of a Flash-Initiated H_2-F_2 Laser," Appl. Phys. Ltrs. 19, 411 (1971)

Suchard, S. N., Kerber, R. L., Emanuel, G., and Whittier, J. S.,"Effect of H_2 Pressure on Pulsed H_2 + F_2 Laser. Experiment and Theory," J. Chem. Phys. 57, 5065 (1972); also, see Suchard, S. N., Kerber, R. L., Emanuel, G., and Whittier, J. S., "Effect of H_2 Pressure on Pulsed

$H_2 + F_2$ Laser. Experiment and Theory," Aerospace Corp., El Segundo, Calif., SAMSO-TR-73-207 (Mar. 1973) (National Techn. Information Service, AD763716)

Suchard, S. N., and Pimentel, G. C., "Deuterium Fluoride Vibrational Overtone Chemical Laser," Appl. Phys. Ltrs. 18, 530 (1971)

Sullivan, J. H., "Deuterium Kinetic Isotope Effect in the Hydrogen-Iodine Reaction," J. Chem. Phys. 39, 3001 (1963)

Tal'roze, V. L., Vasil'ev, G. K., and Batovskii, O. M., "Chemical Lasers Based on Chain and Branched-Chain Reactions," Kinet. Catal. 11, 233 (1970); tr. of Kinet. Katal. 11, 277 (1970)

Thommarson, R. L., and Berend, G. C., "A Classical Trajectory Study of the Effect of Reaction Barrier Height on the Vibrational Energy Transfer Efficiency in the Cl + HCl System," Int. J. Chem. Kinet. 5, 6629 (1973)

Thompson, D. L., "On a Classical Trajectory Study of Energy Transfer in Some Atom-Diatomic Molecule Systems," J. Chem. Phys. 56, 3570 (1972)

Thompson, D. L., "Mechanisms for Hydrogen Halide Vibrational Relaxation," J. Chem. Phys. 57, 2589 (1972)

Thompson, D. L., "Monte Carlo Classical Trajectory Calculation of the Rates of F-Atom Vibrational Relaxation of HF and DF," J. Chem. Phys. 57, 4164 (1972)

Thompson, D. L., "Monte Carlo Classical Trajectory Calculation of the Rates of H- and D-Atom Vibrational Relaxation of HF and DF," J. Chem. Phys. 57, 4170 (1972)

Truhlar, D. G., "Multiple Potential Energy Surfaces for Reactions of Species in Degenerate Electronic States," J. Chem. Phys. 56, 3189 (1972)

Vasil'ev, G. K., Makarov, E. F., Papin, V. G., and Tal'roze, V. L., "Spectroscopic Investigation of the Fluorescent and Radiationless Relaxation of Vibrationally Excited HF Molecules," Dokl. Phys. Chem. 191, 296 (1970); tr. of Dokl. Akad. Nauk SSSR 191, 1077 (1970)

Vasil'ev, G. K., Makarov, E. F., Papin, V. G., and Tal'roze, V. L., "An Investigation of Vibrational Energy Transfer from HF and DF Molecules to CO_2 Molecules," Soviet Phys. JETP 34, 51 (1972); tr. of Zh. Eksp. Teor. Fiz. 61, 97 (1971)

Vedeneev, V. I., Chaikin, A. M., and Shilov, A. E., "Branching in Chain Reactions of Molecular Fluorine," Kinet. Catal. 4, 278 (1963); tr. of Kinet. Katal. 4, 320 (1963)

Vedeneev, V. I., Nosova, V. V., Propoi, V. I., and Sarkisov, O. M., "Mechanism of Self-Ignition in the Reaction of Fluorine with Hydrogen," Russ. J. Phys. Chem. 43, 713 (1969); tr. of Zh. Fiz. Khim. 43, 1288 (1969)

Vedeneev, V. I., Propoi, V. I., and Sarkisov, O. M., "Self-Ignition Limits in the Reaction of Fluorine with Deuterium," Kinet. Catal. 10, 949 (1969); tr. of Kinet. Katal. 10, 1161 (1969)

Vedeneev, V. I., Propoi, V. I., and Sarkisov, O. M., "The Mechanism of Branching in the Reaction between Fluorine and Deuterium. I.," Kinet. Catal. 11, 26 (1970); tr. of Kinet. Katal. 11, 36 (1970)

Wagner, H. G., and Wolfrum, J., "Reactions of Atoms," Angew. Chem. Intern. Ed. Eng. 10, 604 (1971)

Wei, G.-J., and Yankwich, P. E., "Effects of Variations in Reaction Coordinate Eigenvalue and Eigenvector on the Rate and Hydrogen Isotope Effects of the Reaction $H + Cl_2 \rightarrow HCl + Cl$," J. Chem. Phys. 58, 5552 (1973)

Westenberg, A. A., "Reply to Comment by N. S. Snider," J. Chem. Phys. 53, 4117 (1970); also, see Westenberg, A. A., and de Haas, N., "Atom-Molecule Kinetics using ESR Detection. IV. Results for $Cl + H_2 \rightarrow HCl + H$ in Both Directions," J. Chem. Phys. 48, 4405 (1968) and Snider, N. S., "Rate Constants for $Cl + H_2 \rightarrow HCl + H$," J. Chem. Phys. 53, 4116 (1970)

Westenberg, A. A., and de Haas, N., "Atom-Molecule Kinetics using ESR Detection. IV. Results for $Cl + H_2 \rightarrow HCl + H$ in Both Directions," J. Chem. Phys. 48, 4405 (1968)

White, J. M., "Trajectory Study of Reactions in HBr-Br_2 Systems," J. Chem. Phys. 58, 4482 (1973)

Wilkins, R. L., "Competitive Reaction Rates of Hydrogen Atoms with HCl and Cl_2," J. Chem. Phys. 42, 806 (1965)

Wilkins, R. L., "Absolute Rates of the Reaction H_2 + F and F_2 + H," The Aerospace Corp., El Segundo, Calif., SAMSO-TR-71-97 (March 1971) (National Techn. Information Service, AD725031)

Wilkins, R. L., "Monte Carlo Calculations of Reaction Rates and Energy Distributions Among Reaction Products. I. F + H_2 → HF + H," J. Chem. Phys. 57, 912 (1972)

Wilkins, R. L., "Monte Carlo Calculations of Reaction Rates and Energy Distributions Among Reaction Products. III. H + F_2 → HF + F and D + F_2 → DF + F," J. Chem. Phys. 58, 2326 (1973)

Wilkins, R. L., "Monte Carlo Calculations of Reaction Rates and Energy Distribution Among Reaction Products. II. H + HF(v) → H_2(v') + F and H + HF(v) → HF(v') + H," J. Chem. Phys. 58, 3038 (1973)

Wilkins, R. L., "Monte Carlo Calculations of Reaction Rates and Energy Distributions Among Reaction Products. IV. F + HF(v) → HF(v') + F and F + DF(v) → DF(v') + F," J. Chem. Phys. 59, 698 (1973)

Wilson, J., and Stephenson, J. S., "Atmospheric-Pressure Pulsed Chemical Laser," Appl. Phys. Ltrs. 20, 64 (1972)

Wilson, J., Northam, D., and Lewis, P., "HF Laser Action above the Second Explosion Limit," IEEE J. Quant. Electr. QE-9, 202 (1973)

Wood, G. O., "Isotope Exchange vs. Abstraction for H + DCl," J. Chem. Phys. 56, 1723 (1972)

Wood, O. R., and Chang, T. Y., "Transverse-Discharge Hydrogen Halide Lasers," Appl. Phys. Ltrs. 20, 77 (1972)

Yaakov, Y. B., Persky, A., and Klein, F. S., "Temperature Dependence of the Intramolecular Kinetic Isotope Effect in the Reaction System Cl + HD," J. Chem. Phys. 59, 2415 (1973)

Zittel, P. F., and Moore, C. B., "Model for V → T, R Relaxation: CH_4 and CD_4 Mixtures," J. Chem. Phys. 58, 2004 (1973)

NBS-114A (REV. 7-73)

U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET	1. PUBLICATION OR REPORT NO. NBS SP-392	2. Gov't Accession No.	3. Recipient's Accession No.

4. TITLE AND SUBTITLE

Vibrationally Excited Hydrogen Halides: A Bibliography on Chemical Kinetics of Chemiexcitation and Energy Transfer Processes (1958 through 1973)

5. Publication Date: April 1974

6. Performing Organization Code

7. AUTHOR(S)

Francis Westley

8. Performing Organ. Report No.

9. PERFORMING ORGANIZATION NAME AND ADDRESS

NATIONAL BUREAU OF STANDARDS
DEPARTMENT OF COMMERCE
WASHINGTON, D.C. 20234

10. Project/Task/Work Unit No.

11. Contract/Grant No.: AFOSR-ISSA-74-0001-1

12. Sponsoring Organization Name and Complete Address *(Street, City, State, ZIP)*

NBS Office of Standard Reference Data,

Air Force Office of Scientific Research
1400 Wilson Blvd., Arlington, Va. 22209

13. Type of Report & Period Covered: Interim

14. Sponsoring Agency Code

15. SUPPLEMENTARY NOTES

Library of Congress Catalog Card No.: 74-5358.

16. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)*

A bibliography, a reaction oriented list of references, is provided for published papers and reports containing rate data for reactions of halogen atoms with hydrogen-containing compounds, or of H (D, or T) atoms with halogen-containing compounds to form vibrationally chemiexcited hydrogen halides. The reactions for vibroexcitation of hydrogen halides through unimolecular or photochemical elimination, as well as the processes for vibrational energy transfer between hydrogen halides and various second bodies are also included. In addition, four lists of theoretical papers and a list of critical reviews and bibliographies are provided. Over 300 papers covering 50 types of reactions are listed. The period covered extends from 1958 through 1973.

17. KEY WORDS *(six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)*

Bibliography; chemical kinetics; chemiexcitation; gas phase; halogens; hydrogen; hydrogen halides; laser; quenching; vibrational energy transfer.

18. AVAILABILITY

[X] Unlimited

[ ] For Official Distribution. Do Not Release to NTIS

[ ] Order From Sup. of Doc., U.S. Government Printing Office Washington, D.C. 20402, SD Cat. No. C13.10:392

[ ] Order From National Technical Information Service (NTIS) Springfield, Virginia 22151

19. SECURITY CLASS (THIS REPORT): UNCLASSIFIED

21. NO. OF PAGES: 81

20. SECURITY CLASS (THIS PAGE): UNCLASSIFIED

22. Price: $1.30

USCOMM-DC 29042-P74

NBS TECHNICAL PUBLICATIONS

PERIODICALS

JOURNAL OF RESEARCH reports National Bureau of Standards research and development in physics, mathematics, and chemistry. Comprehensive scientific papers give complete details of the work, including laboratory data, experimental procedures, and theoretical and mathematical analyses. Illustrated with photographs, drawings, and charts. Includes listings of other NBS papers as issued.

Published in two sections, available separately:

- **Physics and Chemistry (Section A)**

Papers of interest primarily to scientists working in these fields. This section covers a broad range of physical and chemical research, with major emphasis on standards of physical measurement, fundamental constants, and properties of matter. Issued six times a year. Annual subscription: Domestic, $17.00; Foreign, $21.25.

- **Mathematical Sciences (Section B)**

Studies and compilations designed mainly for the mathematician and theoretical physicist. Topics in mathematical statistics, theory of experiment design, numerical analysis, theoretical physics and chemistry, logical design and programming of computers and computer systems. Short numerical tables. Issued quarterly. Annual subscription: Domestic, $9.00; Foreign, $11.25.

DIMENSIONS, NBS

The best single source of information concerning the Bureau's measurement, research, developmental, cooperative, and publication activities, this monthly publication is designed for the layman and also for the industry-oriented individual whose daily work involves intimate contact with science and technology —*for engineers, chemists, physicists, research managers, product-development managers, and company executives.* Annual subscription: Domestic, $6.50; Foreign, $8.25.

NONPERIODICALS

Applied Mathematics Series. Mathematical tables, manuals, and studies.

Building Science Series. Research results, test methods, and performance criteria of building materials, components, systems, and structures.

Handbooks. Recommended codes of engineering and industrial practice (including safety codes) developed in cooperation with interested industries, professional organizations, and regulatory bodies.

Special Publications. Proceedings of NBS conferences, bibliographies, annual reports, wall charts, pamphlets, etc.

Monographs. Major contributions to the technical literature on various subjects related to the Bureau's scientific and technical activities.

National Standard Reference Data Series. NSRDS provides quantitative data on the physical and chemical properties of materials, compiled from the world's literature and critically evaluated.

Product Standards. Provide requirements for sizes, types, quality, and methods for testing various industrial products. These standards are developed cooperatively with interested Government and industry groups and provide the basis for common understanding of product characteristics for both buyers and sellers. Their use is voluntary.

Technical Notes. This series consists of communications and reports (covering both other-agency and NBS-sponsored work) of limited or transitory interest.

Federal Information Processing Standards Publications. This series is the official publication within the Federal Government for information on standards adopted and promulgated under the Public Law 89–306, and Bureau of the Budget Circular A–86 entitled, Standardization of Data Elements and Codes in Data Systems.

Consumer Information Series. Practical information, based on NBS research and experience, covering areas of interest to the consumer. Easily understandable language and illustrations provide useful background knowledge for shopping in today's technological marketplace.

BIBLIOGRAPHIC SUBSCRIPTION SERVICES

The following current-awareness and literature-survey bibliographies are issued periodically by the Bureau:

Cryogenic Data Center Current Awareness Service (Publications and Reports of Interest in Cryogenics). A literature survey issued weekly. Annual subscription: Domestic, $20.00; foreign, $25.00.

Liquefied Natural Gas. A literature survey issued quarterly. Annual subscription: $20.00.

Superconducting Devices and Materials. A literature survey issued quarterly. Annual subscription: $20.00. Send subscription orders and remittances for the preceding bibliographic services to the U.S. Department of Commerce, National Technical Information Service, Springfield, Va. 22151.

Electromagnetic Metrology Current Awareness Service (Abstracts of Selected Articles on Measurement Techniques and Standards of Electromagnetic Quantities from D-C to Millimeter-Wave Frequencies). Issued monthly. Annual subscription: $100.00 (Special rates for multi-subscriptions). Send subscription order and remittance to the Electromagnetic Metrology Information Center, Electromagnetics Division, National Bureau of Standards, Boulder, Colo. 80302.

Order NBS publications (except Bibliographic Subscription Services) from: Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington, D.C. 20234

OFFICIAL BUSINESS

Penalty for Private Use, $300

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE
COM-215